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THE
YOUNG PAINTER'S
MAULSTICK;
BEING
A PRACTICAL TREATISE ON
P E R S P E C T I V E;
CONTAINING
RULES AND PRINCIPLES
FOR
DELINEATION ON PLANES,

Treated so as to render the Art of Drawing correctly, easy of Attainment even to common Capacities; and entertaining at the same Time, from its Truth and Facility. Founded on the clear mechanical Process of

VIGNOLA AND SIRIGATTI;
UNITED WITH THE THEORETIC PRINCIPLES OF THE CELEBRATED
DR. BROOK TAYLOR.

ADDRESSED
TO STUDENTS IN DRAWING.

BY JAMES MALTON,
ARCHITECT AND DRAFTSMAN.

That not in fancy's maze he wander'd long,
But stoop'd to truth and moraliz'd his song. POPE.

London :

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1800.

TO
BENJAMIN WEST, ESQ;
President
OF THE
ROYAL BRITISH ACADEMY FOR PAINTING,
AND TO THE
ACADEMICIANS and ASSOCIATES
OF THAT
INSTITUTION,

This Work

IS RESPECTFULLY DEDICATED,

With hope that it may be approved by them and esteemed deserving of being recommended to the Attention
of the Students under their Care ;

BY THEIR HUMBLE SERVANT,

JAMES MALTON.

A P O L O G Y.

DESIROUS to avoid every charge of presumption, for presenting a work on Perspective to the public, while so many are extant, and during the lifetime of my father Mr. Thomas Malton, sen. who has himself sent into the world so extensive and so excellent a treatise on the same subject; I deem it but proper to urge a few reasons which actuated me to add another to the number, in vindication of myself, should any be inclined to censure me for having so done.

I had long heard it advanced, and by persons possessing the works of the best informed writers on this head, not excepting even that by my father, that there yet was wanting a practical treatise, which would exemplify the doctrine of delineation, in an easy, familiar, and engaging manner; and wherein its rules might be applied to pleasing and painter-like subjects. I could not but admit the justness of such remarks, nor deny that I had observed the same, and had very early in life felt a strong inclination to be myself the person who should supply that desideratum.

My acquaintance with the subject, according to the elegant principles of Brook Taylor, and my having made frequent, but ineffectual, endeavours to teach it on those principles, and make it engaging at the same time, reduced me to the necessity of adopting the method of practice that is followed throughout this work, which is a mixture of the scientific principles of Brook Taylor, with the clear mechanical mode of Vignola and Sirigatti; making a most pleasing, facile, and entertaining, union; the correctness and dispatch of which manner of delineation is admitted by my father, and slightly treated on by him in the appendix to his valuable work.

Independent of the want of an agreeable method of procedure, the figures whereon the generality of authors on Perspective have employed their rules, have, very feebly, conveyed positive information, being, by much the greater part, ill conceived, and rather disgusting, in lieu of being inviting. The voluminous prolixity of some, obscure brevity of others, trifling littleness of many, and partial application of most of them, have neither rendered the subject interesting, nor given general information. Some have been purely mathematical, others wholly mechanical, and few, or none, seem to have made due reference to the painter. I hope that I shall be found to have proceeded otherwise. By nature I was better gifted with the talent requisite for a painter, than for a mathematician; yet I delighted in the pursuits of both, and was capable at the age of fourteen, to demonstrate any problem in the twelfth book of Euclid, of delineating any regular piece of architecture in perspective, of taking a correct draft from a plaster cast of the human figure, of drawing any of the five orders of architecture, or of copying a landscape of Barratt, or of Gainsborough. This, it will be observed, I advance not with a view of boasting of what I was, or am, capable of performing, but to instance the likelihood there is, that this work will be found less tediously dry, than those of my predecessors on the same subject.

The inclination I entertained, I was earnestly encouraged to the performance of, by persons who judged me competent to the task, some of whom I had the honor to instruct in the art. For ten years past I have been occasionally engaged preparing the subject matter, from my own knowledge of the art, observations from great practice, and remarks from the observations of others, (arising from imperfect knowledge, or erroneous conceptions concerning it,) and arranging and digesting the whole that it might, as much as I could make it, be worthy to meet the master painter's eye, and engage the serious attention of the student.

It is not my intention to attempt to prove that the principles of procedure of this work, are the best that could be given; there being several ways to effect the same end, each may, probably with good reason, have its distinct admirers. It will be sufficient for me to assure my readers that, from knowledge of these various ways, great practice, and experience in teach-

ing, I have ever found mine most expeditious, certain, and easy of attainment. Should any be desirous to fathom the subject to its depth, to gratify a laudable curiosity, they may obtain that satisfaction, by looking into more elaborate works; as my Father's, Highmore's, or Hamilton's, or Brook Taylor's itself; but which labour it was my intention, by this work, to save those whose desire it is to obtain knowledge of the art on just principles, with as little trouble as possible; and with a view to acquire only that sufficiency of it, as to enable them to project ordinary objects with truth and facility.

Throughout this work, I lay claim to as little favour as the gentle critic may be disposed to allow me; I look upon myself as competent to the task I have undertaken, and am not above telling my readers, it has been a matter of twelve years leisure consideration; I hope for that indulgence only, which humanity should ever allow to human frailties. I undertook it with the flattering hope of pleasing all, but now publish it with great fear of not thoroughly satisfying any. Knowledge of perspective has been subject of great delight to me, and cannot but be a pleasure and advantage to every artist. A grateful desire to communicate that advantage to others has been throughout, a considerable motive to my executing this work; other reasons will no doubt be laid to my account, and which I am by no means inclined to disallow; but interest, I can safely assert in this case, yields place to more liberal motives.

Exclamation is but too ready to be made at the great bulk of works on perspective, as also at their expence. It would be adviseable for such persons to resort to Brook Taylor, where they will have no reason to object to either of those considerations. But fully to elucidate and exemplify that author's work, so as to render it clear to common capacities, would extend to a large folio volume or two, with numerous plates. That works on perspective are bulky, arises from the earnest desire their authors have had thoroughly to investigate the subject, that it might be fully understood by those for whose advantage it was designed; bulk therefore should not be cause of objection, what is superfluous, to the discerning, may be passed over. Their expence is certainly still less a matter of complaint, the most voluminous and expensive of them, has seldom I believe, exceeded the sum of three pounds. What would three pounds be towards purchasing any good picture by a great master? which is often done by artists to examine minutely into their principles of colouring, composition, and the like. And is a knowledge of perspective of less consequence? A very sensible writer^a observes, "Whatever some people may think, a picture designed according to the rules of perspective, and the principles of anatomy, will ever be held in higher esteem by good judges, than a picture ill drawn, let it be ever so well coloured. For nature, though she forms men of various colours and complexions, never operates in their motions contrary to the mechanical principles of anatomy, nor, in exhibiting these motions to the eye, against the geometrical laws of perspective." An artist, sensible of any want of knowledge of perspective should purchase and carefully examine every work on the subject that is published, until, from some one, or all, he gleaned every information requisite.

Almost every late author on this subject has taken occasion to observe, that there have been many treatises written on it, probably presuming his would preclude the necessity of any other; but so far am I from intimating or imagining the same of mine, that I hope to see many succeed it, and shall esteem myself happy in forming one step to a ladder by means of which, some one, fortunately favoured, shall happily reach perfection, and compose a work most engaging to where it is most applicable, and that PAINTERS, not MATHEMATICIANS, shall evince to the world most acquaintance with perspective.

^a Count Algarotti, F. R. S. F. S. A.

P R E F A C E.

AT the present æra to enter on any eulogium on painting, or to endeavour to point out its advantages, either to a learned or commercial society, would be, if not impertinent, at least superfluous. Facts that are perfectly established, and which are of themselves indisputable, require not proof. To further the perfection of the art is all that is now required of its advocates: instances of its value, and of the great estimation which it has ever obtained in all polished nations, from those most able to appreciate its worth, are to be found innumerable. No one can reflect on its aid and influence in the fields of science, or consider how it enlarges the channels of manufacture and commerce, without being perfectly sensible of its importance: in an instant does it impart value to worthless materials, and, it may be said, with god-like power, give to shapeless matter, form, life, and beauty! But the Arts themselves, though the great source of wealth to manufactures, disdain to be reduced to their level; they may exalt the humble trades of necessity, but will not float in the same stream; vain, very vain, must every attempt be to *manufacture* Pictures! Even the hand that executed the first production cannot produce an equal copy; the fire, the spirit, the energy, is gone. Painting is the source of the eye's delight, an elegant refiner of life; and inasmuch as it is brought to perfection, is a nation refined, and does sentiment and every virtuous feeling engender that enlarges the mind and expands the human heart.

More than any other art or science, painting labours under disadvantages, as to a certain road to acquirement. The advances of prior explorists avail but little the emulous enterprizing student, like a vessel that proudly traverses the ocean, the pride of art, and admiration of beholders, painting steers her stately course; the artist, who most excels, conducts the helm, but leaves small traces behind to mark her way, or guide her anxious votary's pursuit.

The science of optics, only, lends a considerable portion of certain advantage to painting, in that branch of it which relates to direct vision. This assistance has not been overlooked, but much considered, and copiously treated on by numerous writers, under the head PERSPECTIVE. Perspective gives infallible

rules for delineation ; it is the art of depicting objects on planes, so as truly to represent them as they appear. The very definition anticipates all that can be said in its recommendation. Linear perspective, as far as its effect extends, furnishes a sure and solid foundation to the art of delineation ; but unfortunately, its utility has been insufficiently regarded, and less esteemed by those to whom its information was of the utmost value ; while its merits have been minutely inquired into, and its worth fully established by others, to whom it could impart no practical advantage whatever. By the mathematicians it has long been engrossed, they have industriously ascertained the infallibility and extent of its powers, and from time to time have offered the matured child to its original parents, but indeed so obscured by mathematical symbols, with *theses*, *hypotheses*, and *demonstration*, as scarcely to be recognizable by them, and the painter-student is literally lost “ in the intricate mazes of the *liney* labyrinth.” Artists however, sensible of their right and its advantages, should again resume it, divest it of its obscurities, develop its beauties, and adapt it to their particular researches.

A genius for painting or for poetry, seems almost incompatible with profound skill in mathematical sciences. There are, to be sure, few general rules without exceptions ; not that I know any in the present instance, but there may be both painters and poets deeply conversant with, and who delight in the mathematics ; but this I am inclined to imagine, is by no means common. Reasons for this disunion of pursuits, and where one has some dependance on the other, are not however difficult to be assigned ; the exercise of either of the two former fascinating arts, being produced chiefly by a warm luxuriant imagination, is indignant of restraint ; the fancy, prompt and eager to express its impulses, spurns those trammels that would curb its impetuosity, or retard its endeavours, rejecting the slow, but sure advances of art.

The shortest, and only secure road to knowledge, leads through theory to practice ; a neglect of which procedure, with regard to painting, is the cause of the many erroneous productions which with concern we too frequently witness : nor are such errors lessened when endeavoured to be palliated by the sometimes admissible, but abused, term of licenses. No one can properly be said to have taken a license but he who knows the boundaries of rule. Poets and Painters have their peculiar liberties most liberally granted them, and, used with discretion and judgment, they are ever admitted. He who proceeds licentiously, without inquiry, or guide, must not be surprised to meet the fate of Phæton. It may be said I regard not the rigid

trammels of prescription ; rule shall not confine me ; my *genius* or my *will*, shall have its sway ; *laws* shall not constrain me : Then tell the rules transgressed ? Make known the boundaries broken through ? Assign reasons for so doing ? Unless that can be done, and just motives be advanced in extenuation, all is anarchy, licentiousness, and breach of order. Active genius may not want the spur, but frequently stands in need of the curb.

Sir Joshua Reynolds, in his first discourse delivered to the Royal Academy, speaking of the study and practice of painting in general, says, “ Every opportunity should be taken to discountenance that false and vulgar opinion, that rules are the fetters of genius ; they are fetters only to men of no genius ; as that armour, which upon the strong is an ornament and a defence, upon the weak becomes a load, and cripples the body which it was made to protect. How much liberty may be taken to break through those rules, and, as the Poet expresses it, *To snatch a grace beyond the reach of art*, may be a subsequent consideration, when the pupils become masters themselves. It is then, when their genius has received its utmost improvement, that rules may possibly be dispensed with. But let us not destroy the scaffold, until we have raised the building.”

The modern Painters are less regardful of a knowledge of perspective than were the ancients. By the ancients it was known and cultivated, and their discoveries and opinions of its consequence in painting have been repeatedly handed down to us. By the moderns it is neglected and almost lost ; by many, more than neglected, more than lost, ridiculed, and disingenuously represented. 'Tis true there are some painters ingenious in perspective, and who do earnestly recommend the study of it ; some in my knowledge and whom I could here mention, but for obvious reasons : the same motives however do not withhold me respecting the late Sir Joshua Reynolds, whose incomparable discourses on painting in general are given complete, to an indebted world, by his friend Edward Malone, Esq. and prove that Sir Joshua's knowledge of perspective as well as of painting was consummate.

Rules and precepts have often been drawn up as guides to the young student in the art of painting. Few have been more considered, and in many respects most justly, than those written in Latin verse by Du Fresnoy^a. They compose a work of much labour and learning, and of which there are several translations into English ; one by the celebrated Dryden, in prose, but in a manner not much to his credit, the subject being, apparently, not well understood by him. A poetical

^a A distinguished French Artist, who died in 1665.

translation by Mr. Mason,^a is a masterly performance, and what renders this production still more valuable and complete, is its being accompanied with elucidatory notes by his friend Sir Joshua Reynolds; in the course of which the substance of much important matter is unfolded with additional information.

Among the many pertinent observations in this excellent Poem is one very exceptionable passage on perspective; in which, the Author mistaken himself, or probably not knowing, or not liking the subject, has most unjustly, and incorrectly remarked concerning that only *certain* aid to painting. As this Poem is deservedly much read and in the hands of almost every student, it is but proper that such unfound doctrine should be exposed. In English, by Mr. Mason, the passage is as follows:

“ Yet deem not, Youths, that perspective can give
 “ Those charms *complete* by which your works shall live;
 “ What tho’ her rules may to your hand impart
 “ A quick *mechanic* substitute for *art*,
 “ Yet *formal*, *geometric* shapes she draws;
 “ Hence the true *genius* scorns her *rigid* laws:
 “ By *nature* taught he strikes th’ unerring lines,
 “ Consults his *eye*, and as he *sees* designs.”

Sir Joshua’s good judgment could not let such a passage pass without censure and amendment, which he has done in express terms, but he might have said much more, and it remains to be wished he had given fuller scope to his remarks on the erroneous conception and dangerous tendency of these verses. What he has said is replete with the most accurate judgment, and is of great substance:
 “ Fresnoy, he says, was not aware that he was arguing from the abuse of the art
 “ of Perspective, the business of which is to represent objects as they appear to the
 “ eye, or as they are delineated on a transparent plane placed between the spectator

^a Mr. Mason, in an Introductory Preface to his translation, addressed to Sir J. Reynolds, has these verses on Dryden.

When DRYDEN, worn with sickness, bow’d with years,
 Was doom’d (my friend, let pity warm thy tears)
 The galling pang of penury to feel,
 For ill-plac’d loyalty, and courtly zeal,
 To see that laurel, which his brows o’erspread,
 ‘Transplanted droop on SHADWELL’s barren head,
 The bard oppress’d, yet not subdu’d by fate,

For very bread descended to translate:
 And he, whose fancy, copious as his phrase,
 Could light at will expression’s brightest blaze,
 On FRESNOY’s lay employed his studious hour;
 But niggard there of that melodious pow’r,
 His pen in haste the hireling task to close,
 Transform’d the studied strain to careless prose.

“ and the object. The rules of Perspective, as well as all other rules, may be
 “ injudiciously applied ; and it must be acknowledged that a misapplication of them
 “ is but too frequently found *even in the works of the most considerable artists*. It is
 “ not uncommon to see a figure on the foreground represented nearly twice the
 “ size of another which is supposed to be removed but a few feet behind it ;
 “ this, though true according to rule, will appear monstrous. This error proceeds
 “ from placing the point of distance (vanishing point) too near the point of sight,
 “ by which means the diminution of objects is so sudden, as to appear unnatural,
 “ unless you stand so near the picture as the point of distance requires, which
 “ would be too near for the eye to comprehend the whole picture ; whereas,
 “ if the point of distance is removed so far as the spectator may be supposed to
 “ stand in order to see commodiously, and take within his view the whole, the
 “ figures behind would then suffer under no violent diminution. Du Piles, in
 “ his note on this passage,^a endeavours to confirm Fresnoy in his prejudice by
 “ giving an instance which proves, as he imagines, the uncertainty of the art.
 “ He supposes it employed to delineate the Trajan pillar, the figures on which,
 “ being, as he says, larger at the top than at the bottom, would counteract
 “ the effects of Perspective. The folly of this needs no comment ; I shall only
 “ observe, by the bye, that the fact is not true, the figures on that pillar being
 “ all of the same dimensions :”

“ Yet deem not, youths, that Perspective can give
 “ Those charms *complete* by which your works can live.”

It would be a vain expectation indeed, and such a one as I am persuaded was never formed, to imagine that linear perspective could give *those charms Complete by which alone their works (Painters) should live*. If their works possessed no other charm than linear correctness, they would be of little value, and not likely to charm, or live long. To look, that Perspective should find the true contour of regular objects, and assist in describing irregular ones, is all that was ever wisely hoped from it, and all that it can impart.

“ What tho’ her rules may to your hand impart
 “ A quick *mechanic* substitute for art.”

These verses are absolutely devoid of sense ; yet it may be perceived what is endeavoured to be intimated. By *art* is meant intuition, or genius ; and it wishes

^a Notes by Du Piles, to Dryden’s translation of Fresnoy’s Poem.

to say that intuitive genius is preferable to mechanic skill; and that it is better to possess a fine imagination, even with error, than a plodding correctness without taste.

“ Yet *formal geometric shapes* she draws.”

What has Perspective, in a general sense, to do more particularly with *formal geometric shapes*, than with any other figures? Are the rules and principles of that art applicable only to the Cube, the Tetraedron, the Icosaedron, &c.? Because, in treating expressly on this subject, it is best explained by applying its instructive lessons to regular objects, as being most visibly sensible of its influence, is it to be inferred, that when known to its fullest extent it still rests attached an appendage to architecture only, and has no further application? Who so concludes has very confined notions indeed of its pervading power, which equally governs irregular as regular objects, and has as much influence in the drawing of the human form, as in drawing a regular piece of architecture, or, as termed by Fresnoy, *formal geometric shapes*.

“ Hence the true *genius* scorns her *rigid* laws :

“ By *nature* taught he strikes th’ unerring lines,

“ Consults his *eye*, and as he *sees* designs.”

That pleasing flattering word, Genius! what mischief has it done! and is here given in a very deluding sense, to the undoing of the Pupil, who is hereby led to conceive what he would otherwise probably never have had the boldness to imagine. Sir Joshua Reynolds had, no doubt, observed many instances of the misguidance of that fatal word; and, in his second discourse, places it in the very light it should ever be considered; as a something to be formed and strengthened by reason, but not to soar beyond it. He says, “ There is one precept, however, in which I shall only be opposed by the “ vain, the ignorant, and the idle. I am not afraid that I shall repeat it too “ often. You must have no dependance on your own *genius*. If you have great “ talents, industry will improve them; if you have but moderate abilities, “ industry will supply their deficiency. Nothing is denied to well-directed “ labour : nothing is to be obtained without it. Not to enter into metaphy- “ sical discussions on the nature or essence of genius, I will venture to assert, “ that assiduity unabated by difficulty, and a disposition eagerly directed to “ the object of its pursuit, will produce effects similar to those which some call “ the result of *natural powers*.”

A fine talent by nature will still do little without cultivation ; and it is not an easy matter to draw as we see. To draw as we see, with any tolerable correctness, is the result of knowledge and long attentive practice; and even then do we seldom strike the *unerring* line. According to Reid and other minute investigators of the human organs, sight is the most deceptive sense we have, and particularly requires the aid of experience and judgment. I will now close my remarks on this extraordinary passage, which merited not so much notice but for the general worth of the whole Poem, esteemed the most brief and just in its precepts that ever was penned.

A small treatise on painting was published in 1764 by Count Algarotti, wherein, among various subjects, separately treated on, as of consequence to the completing a painter's education, is a chapter relative to perspective ; and so extremely judicious are the observations, as to the usefulness and necessity of a perfect knowledge of that art, and so forcibly is it there pointed out, that no thinking Artist can read them without being struck with their truth, and determining, if not already acquainted with so useful an information, to obtain the knowledge immediately. I cannot better second that Author's arguments, they so perfectly agree with my own, than by transcribing them. He says, " The study of Perspective
 " should go hand in hand with Anatomy, as not less fundamental and necessary. In
 " fact, the contour of an object drawn upon paper or canvas, represents nothing
 " more than such an intersection of the visual rays sent from the extremities of it
 " to the eye, as would arise on a glass put in the place of the paper or canvas.
 " Now, the situation of an object at the other side of a glass being given, the de-
 " lineation of it on the glass itself, depends entirely on the situation of the eye on
 " this side of the glass, that is to say, on the rules of perspective ; a science, which,
 " contrary to the opinion of most people, extends much farther than the painting
 " of scenes, floors, and what generally goes under the name of quadratura. Per-
 " spective, according to that great master Da Vinci, is to be considered as the reins
 " and rudder of painting. It teaches in what proportion the parts fly from, and
 " lessen upon, the eye ; how figures are to be marshalled upon a plain surface, and
 " foreshortened. It contains, in short, the whole rationale of design.

" Such are the terms, which the masters, best grounded in their profession, have
 " employed to define and commend perspective ; so far were they from calling it
 " a fallacious art, and an insidious guide, as some amongst the moderns have not
 " blushed to do, insisting that it is to be followed no longer than it keeps the high.

“ road, or leads by easy and pleasant paths. But these writers plainly shew, that
“ they are equally ignorant of the nature of perspective, which, founded as it is
“ on geometrical principles, can never lead its votaries astray, and of the nature
“ of their art, which, without the assistance of perspective, cannot, in rigour, ex-
“ pect to make any progress, nay, not so much as delineate a simple contour.”

All must unite in opinion with this informed writer, and agree that the study of perspective should go hand in hand with anatomy as being not less a fundamental information ; he might have said *more* fundamental, for without the assistance of perspective, a knowledge of anatomy would be half useless ; as how could any particular exertion of the muscular frame be expressed without just delineation ? obtainable only from a thorough knowledge of Perspective. Leonardo Da Vinci was precisely of the same opinion, and in his treatise on painting, among numerous pertinent observations on the art, he expressly says, “ Those who venture on
“ the practice, (of painting) without first qualifying themselves in the theory,
“ are like mariners putting out to sea without either helm or compass, ignorant
“ what course to take. The practice ought always to be built on a rational theory,
“ of which perspective is both the guide and the gate ; and, without which, it is
“ impossible to succeed, either in designing, or in any of the arts dependant thereon.”

Leonardo Da Vinci wrote a treatise solely on perspective ; but this, if ever published, I have never seen, but make no doubt, it was confined in its information and principles, comparatively to what is now known and practised. Yet was the knowledge of it then thought materially essential ; in what light would it have been esteemed, perfected as it is at present ? My subject needed not that I should have quoted opinions in support of its usefulness, but I have chosen those great authorities to corroborate and give weight to my own observations on it ; for, as Sir Joshua Reynolds truly observes, “ we are never satisfied with our own opinions,
“ whatever we may pretend, till they are ratified and confirmed by the suffrages
“ of the rest of mankind.”

It is common to hear it advanced, as an apology for not knowing perspective, that the study of it is dry and uninteresting, and that in many cases it is not to be depended on. Allowance must ever be made for difference of taste and opinion : but with all due deference, I should deem the study of anatomy much more dry than that of perspective ; yet with what patient application will a student in painting, emulous of fame, appropriate two, three, four, years of his time to acquire a competent information in that necessary branch of his art. I would ask for what

purpose is so much time spent over skeletons and anatomized human bodies? The answer would most assuredly be, to be correct in the outlines; and that from a knowledge of the causes of action and its effects, appropriate expression may be given in every position, and that, without the aid of a model, and even where a living model would be imperfect, from languor of attitude. If then such labour is necessary to arrive at the knowledge of what *should be drawn*, should that art be neglected which teaches *how* to express those forms, and *how* to transmit them to the canvas? The acquirement of the former information is useless without a knowledge of the latter, of which a competent insight might be acquired in three, or at most in six, months. That perspective is not to be depended on, is an unjust allegation, it is infallible. From injudicious proceeding its delineations may sometimes be distorted, but that is not to be attributed to the deficiency of the art, but to the want of judgment in laying down the proper preliminaries.

That painter is also greatly mistaken, who imagines that perspective is not equally applicable in the delineation of the human form, as of right lined figures. From a want of it, shameful enormities are committed; foreshortened limbs made too long, a figure extended on the ground, feet or head foremost, in a foreshortened position, not represented its just length, often twice the length it should be, and sometimes thrice, of which I could point out but too many instances in works, not of inferior artists. The portrait painter even, frequently shews his deficiency in perspective, by making, as the professors would say, his heads out of drawing; the off-side of the face larger than the near; one eye higher than the other; the nose not in the middle of the face, when not so in the original; and like instances of want of correctness in the sight: but he must not expect to have the compasses in the eye, who has not long held them in his hand. It may be allowed, that great incorrectness is seldom committed, by an attentive, experienced artist; it may be admitted, that the eye by much practice, and nice observation, may become so correct as to render it little liable to great errors; but one twentieth part of the time, by long practice employed to arrive at such critical discernment, spent in acquiring a competent knowledge of perspective, would make an artist of genius much earlier, and infinitely more, correct and decisive.

To every painter some knowledge of Architecture is absolutely necessary; he cannot produce the auxiliaries of buildings to his pictures without it; and the higher are his aims the more informed should he be in this great aid to his effects. 'Tis lamentable to observe the deficiency manifested in this particular, I will use the

words of Sir Joshua Reynolds, “in the works of the most considerable artists,” being as well applicable to their deficiency shewn in knowledge of architecture as perspective. Their pedestals, their capitals, and bases of pillars, their architraves, imposts, &c. from their total want of professional accuracy, exposes them, with concern I have observed it, to the ridicule of the builder’s apprentice. The architecture of an historical piece, or subject of a whole length portrait, may not be a first-rate object, nor a second, nor a third-rate consideration; it may be thrown to any distance of importance, at pleasure; all I mean to dwell on is, that it is thought proper to *be* introduced, then, if introduced at all, though *kept down*^a to any possible degree next to obliteration, it should be properly delineated, by possessing the character of the kind of architecture intended to be represented.

The French painters, in general, shew a laudable attention to their aiding concomitants, be they in what department they will; a fine instance, among many, is shewn in that truly great performance, the portrait of Lewis XVI. by Callet, where the style and correctness of the architecture, and the truth of the perspective, are a reproach to most British productions of the same nature; which, to be rid of that great trouble, are constantly backed by a curtain, or troubled landscape, or clouded sky, even when the subjects are the portraits of noblemen or senators in their robes, or ladies in drawing-room dresses.

The study of perspective combines that of architecture along with it, because the precision of architectural subjects most obviously expresses its effects. The acquirement therefore of a knowledge of perspective has a double advantage, uniting two informations, without the help of which, an artist is necessarily compelled to wander in uncertainty; and to feel his way, as do the blind, uncertain of their path.

And here I cannot avoid remarking on a new proceeding that has lately been adopted, and is daily gaining ground, as it were to the exclusion of *all necessity* of the introduction of architecture, or the effect of perspective in historical subjects, where it would be a proper and almost indispensable requisite; and this is, the practice of crowding three, five, or ten, or more, Herculean figures into the small compass of the frame, so crammed upon one another that sufficient room is not given for action; and the whole appears a scene transacted in a closet, and that of no greater compass than from eight to ten feet square; which small extent of platform has been thought, by some, sufficient space for expressing the ceremony of a public execution, or grandeur of a coronation.

^a A technical term of painting, implying dullness of tint, shunning of inspection.

In scenes of great extent, whether representing transactions within or without the walls of a palace, or castle, appropriate architecture, well introduced, produces grand effects,^a as may be seen in many of the works of the Roman and Venetian schools. Indeed most of their great painters were great architects. I could readily draw out a long list, but the few following names are of sufficient authority and celebrity, to instance that a combination of the two arts is not at all detrimental to either. Leonardo Da Vinci, Raphael, Julio Romano, Hans Holbien, Vafari, Paolo Veronese, Michael Angelo, Rubens, Domenichino, Fresnoy.

Many have a notion that perspective, not only merely relates to architectural subjects, but to them simply when they are represented as receding in the picture, and exhibiting in a small space of a plane placed direct before the eye, the appearance of great depth of structure as retiring farther and farther off, particularly in inside subjects; as looking down the aisles of churches, long galleries, and the like; in which cases, the nearer the eye is to being in the plane of the extent looked at, the shorter will be the space required in which the depth of the subject will be to be delineated, and the greater and more sudden the apparent convergency of horizontal lines. Such delineations appearing to the not well-informed in the subject of delineation, unpleasing pictures, and not being able to reconcile to their minds, what is, apparently, so repugnant to truth, I have heard it observed that such subjects were too much in perspective, when it was only meant to imply, that the point of view was taken too closely to the plane of the building, to have a satisfactory, and pleasing picture of the object. To say any subject is drawn too much in perspective, is tantamount to saying, it is too well, or too naturally, represented.

Among the various informations and acquirements forming a polite and liberal education, as well of a lady, as of a gentleman, the art of drawing ever did, and

^a One of the greatest painters of the present day, I know, entertains very just, and, I believe, original ideas, as to the applicable introduction of architecture into historical compositions. When the subject is of a solemn kind, as a funereal or sacred procession, the architecture, he considers, should be of few parts, grave, massive, and very little ornamented, with its horizontals in a parallel direction, or nearly so, with the picture; in subjects of less gravity, the architecture may admit of more division, be lighter and more ornamented, and a quicker declination of horizontals may be more congenial; in scenes of mirth and festivity, the architecture may be severed, various, light, and ornamented. To the feeling mind I cannot better instance what I understand of these notions than by drawing a parallel to them from poetry, and Pope's Essay on Criticism furnishes me with an admirable one.

When Ajax strives some rocks' vast weight to throw,
The line too labours, and the words move slow:
Not so, when swift Camilla scours the plain,
Flies o're th' unbending corn, and skims along the main,

always will, hold a distinguished place. The certain and general principles for attaining that elegant accomplishment, which perspective affords, are absolutely necessary to be known, to draw even the slightest sketch from nature with precision; and to judge with truth the works of others. The desire of attaining to great excellence in any art would be considerably checked, if there were not to be found admirers sufficiently informed in their judgment, as to be well able to discriminate difference of excellence. The praise of having done well, is a powerful inducement to further improvement.

Drawing, in my opinion, is a vehicle of communication among mankind, as necessary to be somewhat informed in, as the art of writing. The pen may express our sentiments, but not always our ideas and conceptions; at times, that can alone be done by the pencil. A mechanic is required to execute a new and singular piece of work; it is impossible he can thoroughly conceive it without a draft, the which, not being able to give, is a species of ignorance nearly as great as the not being able to write; and a deficiency that many an intelligent person has mortifyingly and detrimentally experienced. The most laboured description of scenes, conveys not half so perfect an idea of their form and effect, as a few just lines of the pencil. Drawing is an universal language, comprehensible to a very savage, and plainly speaks to every eye. No person therefore, desirous of a liberal education, should be deficient in a tolerable acquaintance with the first principles of delineation, perspective.

Few who take upon them the task of teaching drawing, are qualified for the profession they engage in. In Landscape drawing, the pupil is set to copy houses, trees, &c. after a promiscuous manner, to resemble as nearly as they are able those of their originals; but without being made acquainted with any fixed principles of delineation in general. They advance from simple to complex subjects, and, when capable of making a tolerably decent copy in colors, are looked upon to be greatly skilful; though at the same time they are as incapable of doing any thing original, or of taking a view from nature, as if they never had handled a pencil. They are made to draw slant lines to represent horizontal ones; to make parallel lines tend to a point of union; ovals to represent circles; acute, or obtuse angles to represent right ones; but without being shewn the reason, or having the cause demonstrated to them, why they do so.

It is common for persons after long instruction in drawing, under what are termed able masters, and after they have obtained great proficiency in copying, to request being informed how they are to take a view; to do which they feel themselves as

incapable, as would be their pencil without the guide of the hand and judgment. This would not be the case had their masters, from time to time, inculcated the principles of perspective, by giving familiar objects, as chairs, tables, or other furniture, or small models which they might furnish, to be drawn as they would appear in different places and positions; and after descanting on, and correcting the sketches of them, proceed with their pupils to delineate the same exactly by rule, from determined stations. The solid knowledge that would be thus instilled and ingrafted on the more pleasurable part of the art, would so deeply fix the whole, as would render it permanent and readily useful, whether in copying, composing, or drawing from actual nature.

The whole of my Theory, if it can be called one, is contained in the introduction. I have there briefly explained the nature of, and how to produce perspective delineations of given, or known objects, from determined stations. After the Introduction I proceed to the practice, where, by the clearest, and simplest method that I could devise, I have traced the subject, in regular progression to the end of my proposed design. To the reflecting mind 'tis needless to observe that the number of examples given might exceed all bounds, were endeavour made at introducing every possible case that might be suggested. In pursuance of my plan the most prominent features only have been the object of my attention; subordinate ones, and repetition, must be left to the care and practice of the student.

That I might make this work as useful and as compact as I well could, and that it might contain in itself every information necessary to the prosecution of the subject, I have prefaced the practice of Perspective with some problems and observations on practical Geometry; giving such only as are indispensibly necessary to enable the student to draw correctly the schemes required in the practice of perspective delineations. This I have done, as I consider it extremely discouraging, and destructive of the end required, to tell the reader, who opens a book for some pleasing and necessary information, that he has first something else to learn, as a prior knowledge, and which is not there to be obtained, before he can comprehend what he is in search of, and desirous to know. And this is still more repulsive, when probably the sufficiency of such prior knowledge is so trivial, that it could all be expressed in a few pages; to avoid the little addition of which, the student is turned back, and left to search for the mentioned books without guide or direction of how much, or how little of it, it is necessary he should make himself acquainted with; a circumstance so discouraging as frequently to end in a total neglect of both.

Without a good share of ingenuity and resolution, 'tis impossible to become thoroughly acquainted with any art or science by self study, from book alone. In the first place, what is there said, if not clearly intelligible at first, expresses but the same on a second reading, nor is it placed in any new light on a third; and the student is left to ponder and work his way, as his genius and his patience suits: but let it be observed, no information obtains so deep a root as that we give ourselves.

With information and inclination competent to advance, all difficulties will speedily vanish, all clouds of darkness will disperse, and a bright and clear prospect open to the view; there may indeed a few swamps and brambles obstruct the path and impede progress; but these I shall not only endeavour to remove, but will place such step-stones and finger-posts in the way as will ensure a certain road, and leave little chance of being bewildered, or lost in a mire. Should my traveller be led unexpectedly into a path apart from the main road, he may rest assured it will be to notice a prospect by the way that otherwise might have escaped his observation, and that he will be brought a gainer thereby, to the place whence he started; his mind expanded and eager for further discovery. Through the whole I will be the companion of his travels, nor will I enforce my principles by harsh or severe means, but use him as a friend that I would wish to inform. To drop the metaphor, I will do my endeavour to advance step by step unto the end of my pursuit, with a careful attention to the capacity of my student; advance not any thing I cannot prove, nor leave aught, if possible, not clearly explained and investigated. All controverted points I shall keep to be discussed at the last, they having nothing to do with true and just representation, may be looked into, or not, at the option of the reader; though it does not behove me to pass them unnoticed.

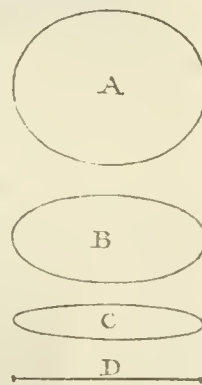
How far I have succeeded in my endeavours at simplifying and generalizing my subject, the public, who are now become my judges, must determine. How far I have justly expressed my conceptions, or how satisfactorily conveyed to others a source of great pleasure to myself, I cannot say; but of this I am assured, that the study and practice of perspective may be made as entertaining as any branch of painting whatever, except coloring, and giving relief of light and shade, which is the last thing a painter has to study, and which he can never be said to have acquired.

INTRODUCTION.

EVERY thing we see is seen perspectively ; whether it be a house, a man, or beast, or tree, or ship, or plains, or hills, or water, or all together. It will appear a strange contradiction to advance, but which in a few words I hope to make clear and manifest, that no object whatever *appears* as it *is*, in any one point of view ; that is, presents a figure to the eye such as we know it to possess, but one object alone excepted ; which object is a globe. A globe in every point of view, and to every eye at the same time looking at it, and in every direction, appears a globe, or spherical body bounded by a circular line. Every other object assumes, apparently, a different form in every change of position, or different point of view whence it is seen. A circle, for instance, the most perfect of plane figures, never appears a circle but in one point of view, and that is, when the eye is perpendicularly over the center of it : in every other situation its appearance is an oval, more or less extended, the more or less the eye is in the direction of its plane ; like figures A, B, and C : when the eye is in the direction of the plane of the circle, then is its appearance a right line, as the line D.

Parallel right lines never appear parallel ; consequently a square can never appear a square.

There is no one capable of making serious reflection, and of drawing consequences from certain principles, but must be sensible and admit, that of two equal heights, one placed nearer the observer than the other, that that which is farther off will appear less than the one that is nearer. Apparent diminution of size, is the reason for concluding distance of objects : we do not scruple to say of two men, or of two ships, of known equal dimensions, that one is farther off than the other, because one appears less than the other ; and that one is much farther off, because it appears much less.



This principle being admitted, the consequences take place in every degree of distance, however great, or however small. If the eye of a spectator be at E, (Fig. 1, Plate 1,) looking at a height, as AB, and an equal height be at CD, farther from the eye than AB, then will the nearer height AB, appear to the eye somewhat higher than the equal, but more distant, height CD. For which reason, parallel right lines, as was before advanced, can never appear parallel, not even when they are direct before the eye, as the lines AB, and CD. Fig. 2. For if the eye be opposite the middle between the extremes of the lines, suppose opposite the point E, then would the distance of the two lines at E, as FG, appear greater than the same height AC, or BD, at the two extremes; because they are equal heights seen at greater distances. Consequently the parallel sides of a square can never appear parallel, nor the figure be seen as it really is: But more or less curved, according as the eye is nearer or more remote from the parallel lines regarded.

Now the business of drawing, that is, of drawing perspectively, is to delineate things as they appear, in every possible direction that they can be presented to the eye; and not as they are, or as we know them to be. Thus of a book, supposed placed in various positions on a table, as Figs. 3, 4, 5, and 6, which, though all correct delineations of the same object, are nevertheless all different in their representations, expressing the book as seen in as many different positions. If a basin is delineated, as standing on a table, it is most commonly represented as Fig. 7, which may be truly its appearance from a certain point of view, and satisfactorily indicate the real form, in the situation intended, to most beholders; yet is neither the basin, nor the table it is represented standing on, such figures as the table and the basin are really known to be; for the tops of both are known to be truly circles; yet in their *representations* they are made ovals, and ovals very much extended.

Let a square box, which, for particular reasons, we will suppose of cubical form, that is, having every side a square, be required to be delineated. It is often satisfactorily represented, as Fig. 8, with one side a square, and the top not in the least like a square, but which has the appearance of a square horizontally situated. Or a representation may be given, as Fig. 9, with two sides and a top seen, of which one side only shall actually be a square, the other side, and top, very different figures, yet appearing the representations of squares so placed. Or a cubical form may be represented, as Fig. 10, when neither side nor top shall be actual squares, yet all do appear as such, and the whole together conveys a just idea of the object intended to

Fig. 1.

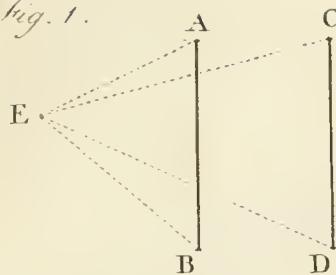


Fig. 2.

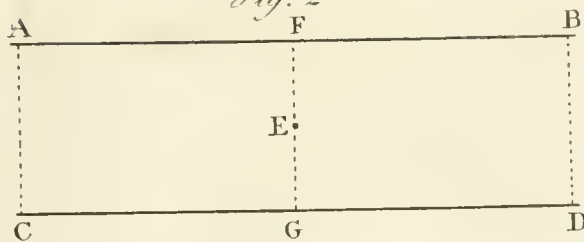


Fig. 7.



Fig. 3.



Fig. 5.

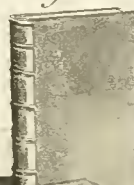


Fig. 6.



Fig. 4.

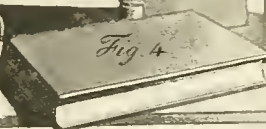


Fig. 8.

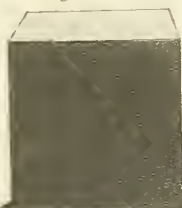


Fig. 9.

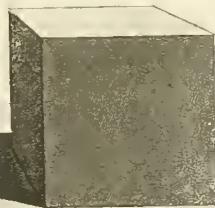


Fig. 10.

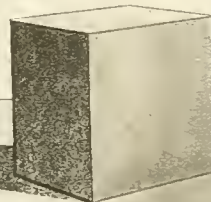


Fig. 11.

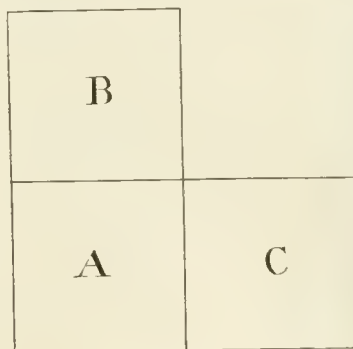


Fig. 12.

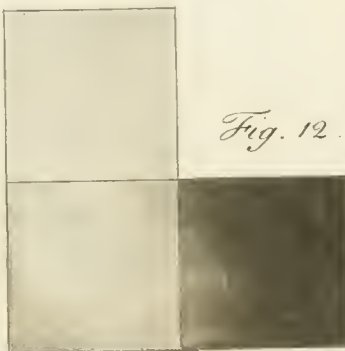


Fig. 1.



Fig. 2

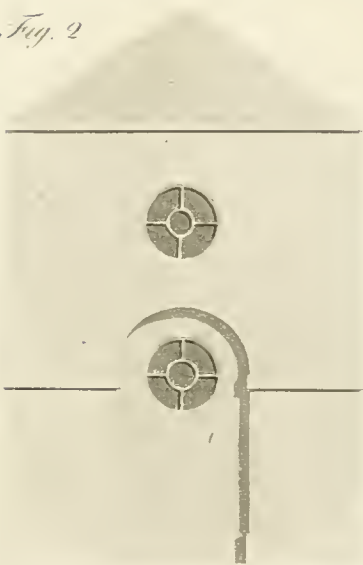


Fig. 3



be represented : and notwithstanding the three delineations differ so essentially from each other, yet do they all, and each, convey the idea of the same form, but differently posited.

Now this effect could not be obtained, by making the representation of each side of the object seen, a square, the better to indicate a square; for suppose one only so represented, as A, Fig. 11, (and one only, of the same object, can be truly so) the top, B, will not appear a square as placed horizontally, and at a distance from you, by being made a square; neither will the second side, C, appear a square, as placed at right angles with the other, by being made a square; but altogether will have the appearance of three superficies, all in a vertical plane, and have no semblance of a solid body; not even when assisted with the effect of light and shade; as Fig. 12. for the linear delineation not affecting the eye as the contour of a solid body, the three squares will appear but as one superficies, variously shaded.

What has been said of the above particular figures, may be applied to *any* and to *every* figure: a man, a tree, a ship, or any form that exists. Thus when a man is represented with one leg longer than the other, or one arm longer than the other, it is not to be inferred from thence that one leg, or one arm, because not drawn at full length, is meant to represent an arm, or leg, shorter than the other; but that the leg or arm so represented, is seen, as painters express themselves, foreshortened, or contracted in its manner of presentation to the eye; and so of every different position. A tree, in one point of view, shall appear of very different figure to the same tree in another point of view; so of a ship; and so of every object of art or nature.

It is really strange, though not unaccountable, that though we *never* see objects as they *are*, but always as they *appear*, that is, perspectively; yet in drawings of houses, what are termed geometrical drawings, appear, to the many, to be the most satisfactory representations of them.

For the satisfaction of the uninformed in this particular, I will briefly explain the difference that subsists between these two modes of representation, geometrical and perspective; that the terms geometrical and perspective drawing, may be immediately and clearly understood in future on the mention; and after a few observations thereon, proceed with my subject.

By a geometrical representation, as of a house for instance, is understood, that the whole, and every part of it, is drawn according to the strict rules of geometry: that is, that every circle be drawn a true circle; every semi-circle a true semi-circle; every square be made a true square, with its opposite sides parallel, and its angles right ones; and that all parallel lines, in every direction, be really made

parallel. Under all which agreements, Fig. 1, Plate 2, is a geometrical elevation of a house, wherein may be observed that the circles are true circles; the squares are true squares; that all its windows, intended to be equal, are made equal and alike; and that all horizontal and vertical lines are strictly parallel to each other. Fig. 2, is the geometrical elevation of the end of the same building. Such delineations are what are termed geometrical drawings, and are such as are implied when reference is made, in this work, to drawings of objects *as they are*.

A perspective drawing of a house, is the representation of a house as it appears, when viewed from any particular station. Fig. 3, is a perspective representation of the before-explained geometrical drawings, in which it may be observed that there is no one figure delineated like unto the originals of which they are the representations. Circles and semi-circles are represented by ovals and half ovals; squares are described of the figures of lozenges, or more properly of trapeziums; none of their angles are right ones, some being very obtuse, and others very acute; none of its parallel lines, except the vertical ones, are parallel; neither are any two of its corresponding windows of a size, though intended to represent equal and alike windows. And though this be the universal language of nature, and the only presentations ever offered to our eyes, yet are they not so well comprehended in general as are geometrical delineations; which, though it may appear paradoxical to assert, are absurd delineations, and no representation of any real object at all.

I would not have it supposed that I mean to imply, there is no utility in geometrical drawings; my meaning here is, only relative to their not being representations of existing forms as they appear.

Now though geometrical appearances, in real objects, *never* can be seen, and perspective ones always *are* seen, yet do the first, in representation, seem more satisfactory to the untutored eye than the other; which, overlooking the appearance of objects, immediately reverts to the thing signified; and knowing that houses in reality are equally high at their extremes, and that their tops are level, and parallel to their bottoms, immediately conclude the former to be true representations, and the latter erroneous conceptions, which, though frequently committed, cannot be defended or accounted for.

If it be positively true that these irregular figures take place as the representations of others of truly regular forms, is it to be concluded there is some determinate precise form of representation, from certain consequences? or is it all random work, and left to the guidance of the eye and reason only? The whole is governed by rule, and there is a determinate mode of procedure, upon infallible prin-

ciples ; by which, knowing the plan and form of the object, and distance and height of the eye that views it, a perfect delineation shall be effected ; which may so impose upon the eye, as to be mistaken for the object itself. I will now enter on this important subject, but previously it will be necessary to explain some introductory matter, upon which the certainty of effecting this desirable end is grounded.

The truth of perspective representations depends upon an established and certain principle in optics, *that vision, through the same medium, is conveyed in right lines to the eye.* If the attention of the eye be directed to any particular spot, it obtains its perception, by a ray of vision, or of light, extending in a right line between the object and the eye : thus, the eye at E, fig. 1, upon looking at the point A, forms, what is termed in optics, a ray of vision, or visual ray, EA, extending in a right line between the point of observance and the eye ; which line of vision it is contended, is a right line ; and should any other object, as B, intervene between the first point, A, and the eye, so as to touch the visual ray, it would effectually hide the point A from view of the eye at E. To prove that a ray of vision directed from the eye to any particular point, is a right line, and not a curved one, as ECA, the following simple experiment may easily be tried, which, answering, will incontestibly establish the fact. Place any height, as AB, (Fig. 2.) before the eye, at E ; half way between the sight and the first height AB, place a second height, as CD, so placed, that the other may be seen immediately behind it. Then directing the eye to the bottom of the object, mark the place where it will appear (which it will do) to touch the first height, as at *b* ; then direct the eye to the top of the far object, and mark where it will appear to touch the first height, as at *a* ; then if the space comprehended between *a* and *b*, be but half the height of AB, it will be clear that the visual rays EA and EB, directed from the eye at E, to the points A and B, are right lines.

To my reader conversant in geometry, further proof need not be given of the certainty of the visual rays EA and EB being right lines, than has just now been stated. The line *ab* is half the line AB, but the line AB is parallel to *ab*, and twice as far from the point E ; then will the lines E *a* A, and E *b* B, be right lines, and the triangles E *a* b, and EAB, be similar.

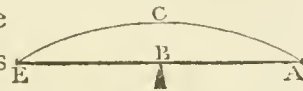
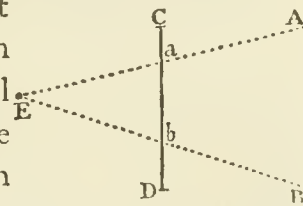


Fig. 2.

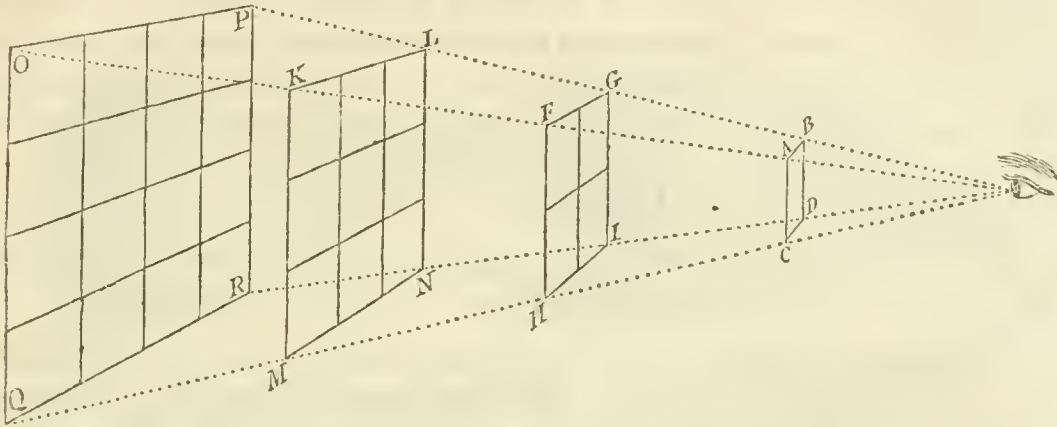


It would be entirely foreign to the purposes of perspective, to enter more on the subject of optics; the establishment of this single fact, paves the way to the certainty of all delineation on planes. To prove that rays of vision are subject to refraction, as they pass through mediums of different densities, would be entirely irrelevant to the present pursuit, which has only one medium of optical pervicuity under consideration, Air; and to that alone we are to be confined. Neither would it be of any account to the present inquiry, to investigate the nature or essence of light; for whether it is material, or immaterial, is perfectly unimportant here. On such points of contention it is neither my province, nor my inclination, to dwell: it only regards the subject in question to establish, not by what *means* vision is performed, but, that it *is conveyed in right lines from the eye*, the eye and the object being in the same medium of light; of which I hope demonstrative, but of which I am certain, (the enquiry answering the proposition) practical, proof has been given.

On the certainty of the direct procedure of the visual rays from the eye, it is, that we are capable of calculating the exact apparent dimensions of objects, as they are more and more remote from us. Not that this calculation is of any particular service in perspective delineations, but only as it obtains incontestible proof of what otherwise might remain doubtful, the exact proportion of diminution that does take place; and which is, *in the inverse ratio of the squares of their distances from the eye that regards them*. If an object be at a certain distance from the eye, it will appear four times the dimensions of an equal object seen at twice that distance; nine times the dimensions of an equal body placed at three times the distance; sixteen times as large as an equal body at four times the distance; and so on, inversely as the squares of the distances; that is, inasmuch as the squares of the distances increase, in the same ratio do their apparent magnitudes diminish.

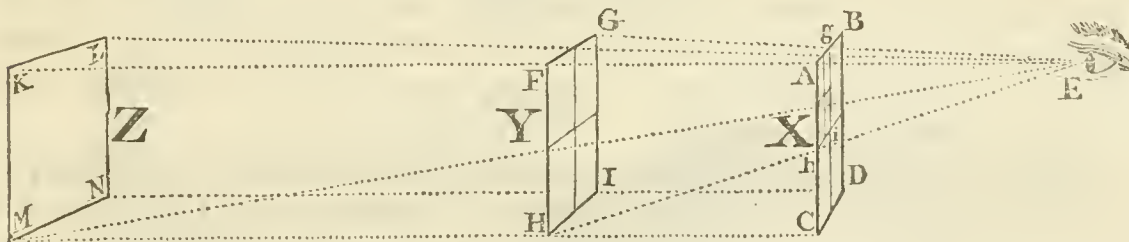
If a square, as ABCD, be placed before the eye, it will cover, and hide from view a square of four times its dimensions, at twice the distance, as FGHI: consequently, an equal square, at twice the distance, will appear but a fourth part the dimensions of the first, as any one of the four squares marked on FGHI. The distance is 2, the square of which is 4, the inverse then is only a quarter, or a fourth part. At three times the distance of the first square from the eye, it will cover a square of nine times the dimensions, as KLMN; of consequence an equal square there, would appear but a ninth part the size; the square of 3 being 9, the inverse of which would be but a ninth part. At four

times the distance, it would hide a square of sixteen times its dimensions, as the square *OPQR*, determining an equal square there placed, to appear but a sixteenth part its size; the square of 4 being 16, the inverse is but a sixteenth



part. So the proportion, or ratio, would go on to infinity, agreeably to the inverse of the squares of the distances; if at five times the distance, but a twenty-fifth part; and, if at ten times, but a hundredth part.

Probably the investigation of this curious circumstance may be aided by an examination of the following diagram: where



are three equal squares, *X*, *Y*, and *Z*, placed direct before the eye at *E*, each having one corner touching the same visual ray to the eye, *K F A E*; of consequence, being all vertical, and parallel to each other, their tops and near perpendicular sides, are all in the same planes of vision. The square *Y* being twice the distance from the eye at *E*, that the square *X* is, appears, to that eye, but a fourth part the dimensions of the first square; as is manifest by the visual rays *FE*, *GE*, and *HE*, which passing the plane *X*, touch it in the points *A*, *g*, and *h*, determining the square *A g h i*, as its apparent magnitude, when compared with the square *X*; which square *A g h i*, is but a fourth part the square *X*; for the line *A h*, is but half the line *A C*, and *A g*, but half *A B*; of consequence then the square *A g h i*, is but quarter of the square *A B C D*, or super-

ficies X. In the same diagram, the square Z is four times the distance from the eye that is the square X; on which account its apparent dimensions are, when compared to the square X, but a sixteenth part of the square X, as is clearly evident by the visual rays K E, L E, and M E, which, intersecting the square X, determines thereon, a square equal a fourth part of the square Agh i, and consequently but a sixteenth part of the square X; an apparent diminution agreeably to the proportion intimated, being *inversely as the squares of the distances*.

DEFINITION

1. A VISUAL RAY. Is an imaginary right line extended from the eye, to any particular point, the object of the eye's regard, or contemplation.

It is curious to observe the play of the eye, while it is employed in minutely surveying any particular object, or objects; to remark its gradual shiftings as it changes the immediate spot of contemplation to the regarding of another, or others. It will naturally result from this consideration, and the knowledge of visual rays being right lines, that no two spots can be so near, but that the direction of the eye will be changed, and a new visual ray be formed, in the separately examining the one and the other. Observe but the dial of a watch; and the motion of the shifting of the eye will not only be felt as it passes from regarding one hour to another, but it will be sensibly felt as it glides by the minutes; evincing in its progress a subtlety of motion, superior to the mechanism of the delicate machine it contemplates.

From the shifting of the eye, while employed in examination of any object, or number of objects, it may be figured that while contemplating the borders of a circle (as the minutes of the dial of a watch), there would be generated a cone of visual rays, of which the eye is the apex, or point, and the dial the base; as Fig. 1, Plate 3. And it must of course be reflected, that, as the objects of contemplation differ in figure, so must vary the body of the collection of rays proceeding from the eye in their examination. As, suppose the object a square superficies, see Fig. 2. then will there be generated a pyramid of rays; if it be a triangle, then is there another pyramid formed, having a triangular base, as Fig. 3; or, the object being a solid, as Fig. 4; or the figure may be a man, or beast, as Fig. 5. and 6. it matters not what, on the eye's regarding them all around, there will be formed a body of visual rays, of which the contour of the object regarded, be it what it will, is the base, and the eye the apex.

PLATE 3

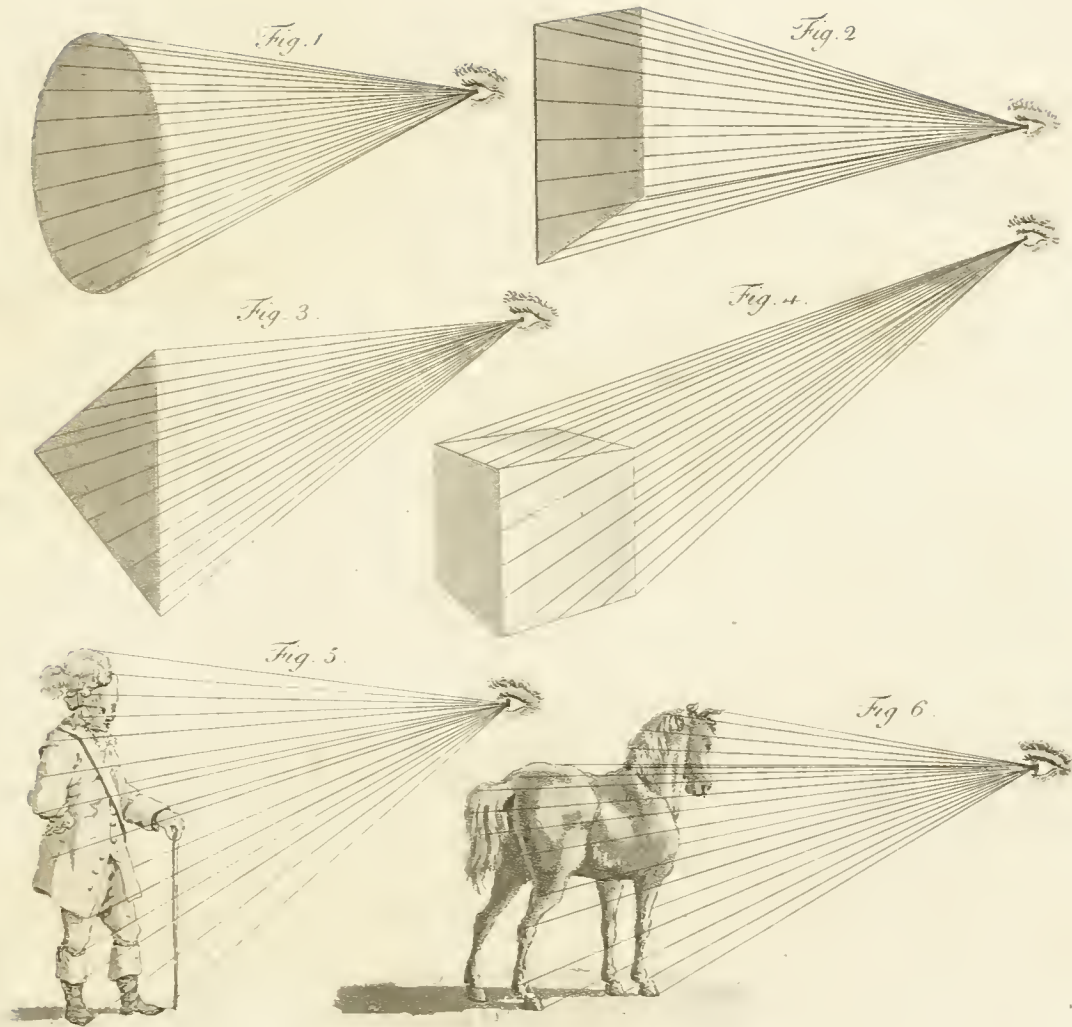


Fig. 1.

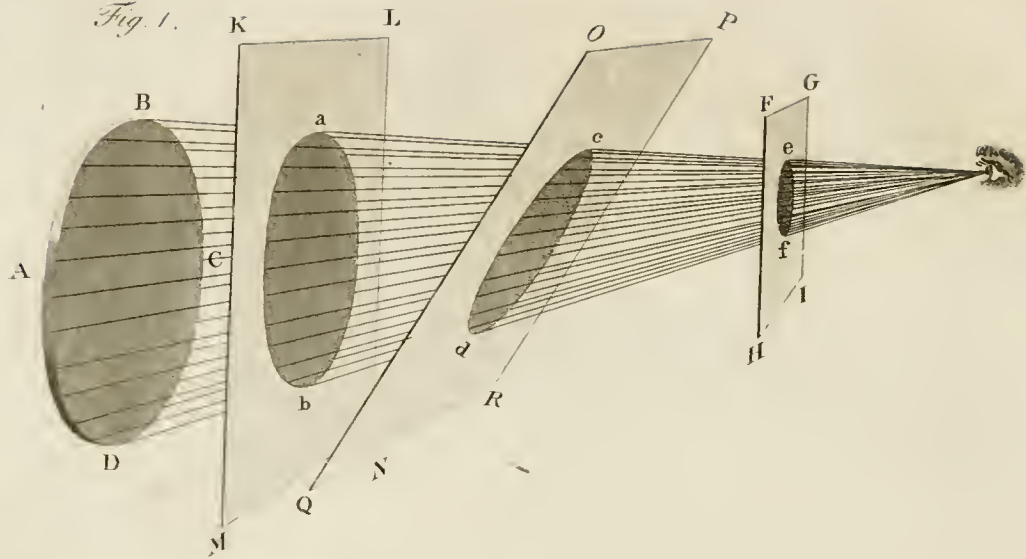
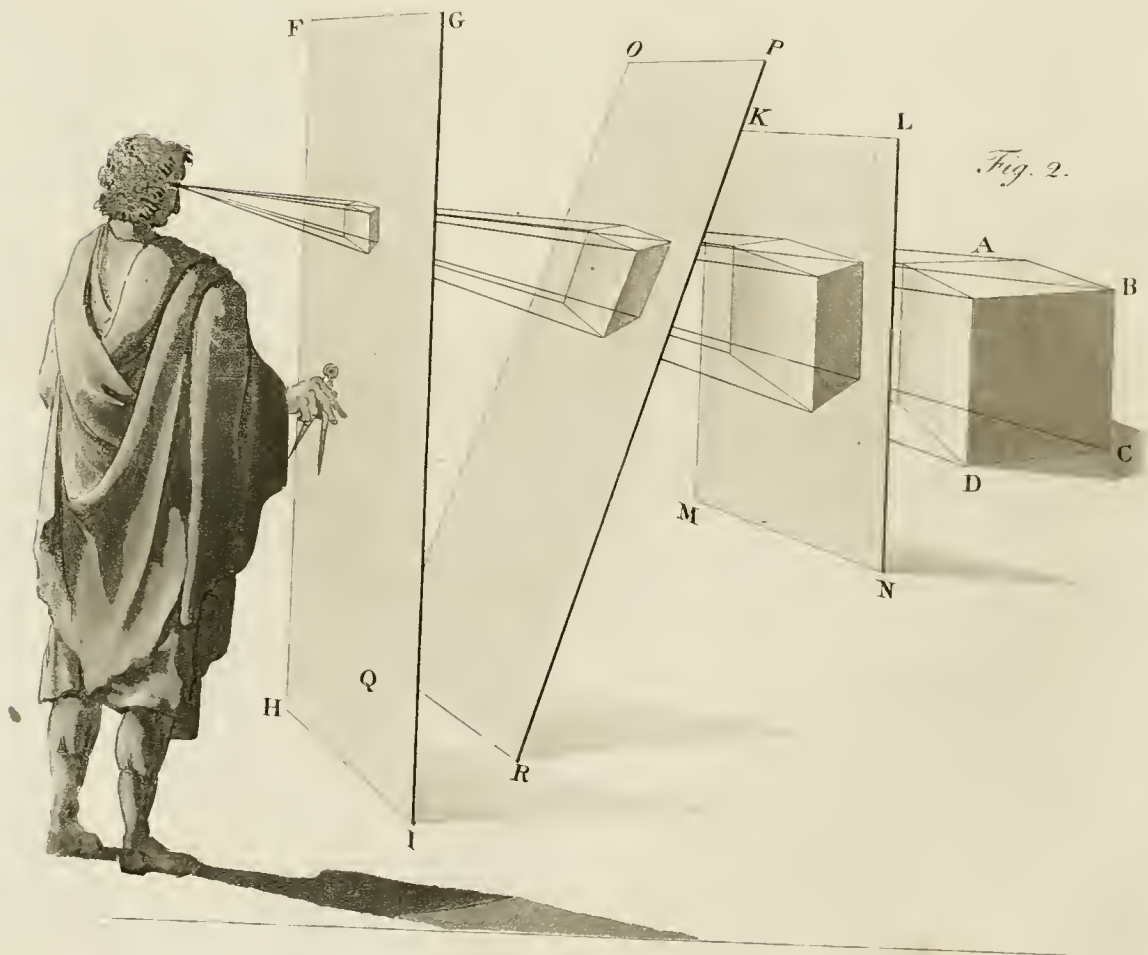


Fig. 2.



DEFINITION

2. VISUAL RAYS. Are any number of imaginary right lines proceeding from the eye, to any object the subject of its contemplation.

If the pyramid of visual rays proceeding from the eye while contemplating an object, be cut by a plane making a section of those rays, the figure that would be generated on the plane by such section, would be what is termed a perspective representation of that object; which section would be varied in figure and in dimensions, accordingly as the plane making it, was inclined one way or another, and accordingly as it was taken nearer the eye, or nearer the object. Parallel sections would be similar figures, and all otherwise than parallel, dissimilar.

Thus of the cone of visual rays, proceeding from the circle *ABCD*, Fig. 1. Plate 4; the section *ef*, made by the plane *FGHI*, being nearer the eye than *a b*, made by the parallel plane *KLMN*, the former figure, though similar, is smaller; and the section *cd*, made by the inclined plane *OPQR*, is different in figure from those made by either of the two vertical planes. So of the pyramid of rays proceeding from the cube *ABCD*, Fig. 2; the sections made by the parallel planes *FGHI* and *KLMN* are similar, but differ in size from each other, and in figure from that made by the plane *OPQR* on account of its inclined position.

DEFINITION

3. A PERSPECTIVE DELINEATION. Is a linear representation of any object or objects, as they appear to the eye that regards them: and is such a figure as may be supposed to be made by a plane making a section of the body or pyramid of visual rays directed from the eye to the objects, while contemplating of them. Which delineation, being so tinted as to resemble the local colours of the real objects, and having the effect of light and shade, will convey a lively idea of the real objects, and at the same time indicate their position and distance from the eye of the observer.

A Perspective representation of any object, or multitude of objects, is such a representation as would appear to be made on a plate of glass, placed between the eye, and the object or objects of examination. A view seen through the window of a room, is, as it appears on that window, a perspective representation of that view; and if the sight could be kept confined, and the hand at the same time were to trace the figures of the objects on the glass, where they appear to touch it, the picture so drawn upon the glass, would be a perfect perspective view of the prospect behind it.

It must however be obvious, that every change made in the place of the eye, or the position of the transparent plane, must make a difference in the figure and dimensions of the section of visual rays; if the plane of glass be placed near the eye the section will be small; and as the glass is removed nearer to the object, the section, or representative figure, will proportionably increase: also, the plane of glass may be so posited, as to produce very distorted figures indeed, but of that in another place.

Inclined sections of the pyramids of rays, that is, not vertical ones, are sometimes taken, as subjects of curiosity; but seldom as objects of utility. As subjects of pictures they are universally vertically taken, and, until the conclusion of this work, when specially treating on such subjects, they will uniformly be so considered.

Suppose, while the eye is fixed looking through a sight-hole as at E, (Fig. 1, Plate 5.) at an object, as A B C D F G, a plate of glass were placed vertically between the eye and the object; as the plane H I K L. And suppose the face of the plane of glass, towards the eye, to have been finely dusted over with hair-powder; not so as to render it impervious to the sight, but so, that the objects might nevertheless be distinctly seen through it. Keeping the eye fixed at the sight-hole, a steady hand could then trace on the glass the contour of the object, as it would appear through that glass, and would mark the figure *a b c d f g*.

Now it is the business of the rules of perspective to find such figure, on an opaque surface, as paper, from some certain data given or known, as would, when obtained, and properly placed between the object and the eye, affect the eye the same as the one traced on the glass; for the proof of which, the figure being out, the real object shall exactly appear through and fit the aperture; as in Fig. 2, the object does, through the aperture *a b c d f g*, to the eye of the observer at E.

Having the two extremes of a right line, the whole line is obtained, by drawing it from one extreme to the other; therefore to find the perspective of the figure A B C D F G (Fig. 3.) it is only necessary to find the points of intersection of the visual rays E A, E B, E C, E D, &c. from the visible angles of the object, as they would pierce the plane H I K L, in the corresponding points *a b c d f g*, the lines then being joined together, in their respective directions, as is there done, the whole figure is obtained, which is the representation of the contour of the object required to be delineated.

Thus, I hope, I have clearly shewn what is *meant* by perspective representations. I will next proceed to trace a simple method by which they may be *obtained*, and at the same time will endeavour to explain the infallibility and truth of the process.

Fig: 1.

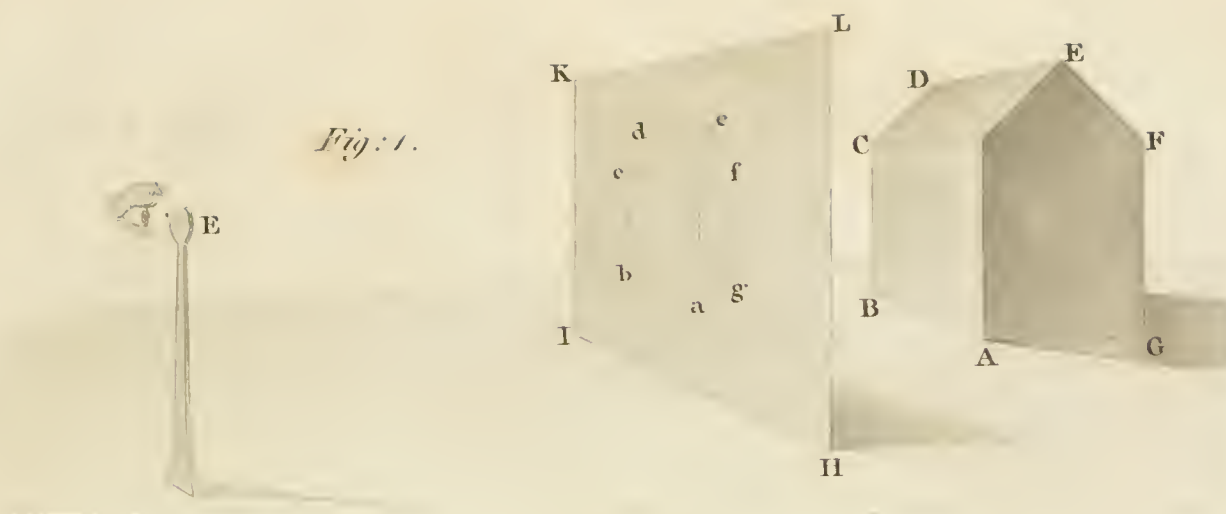


Fig: 2

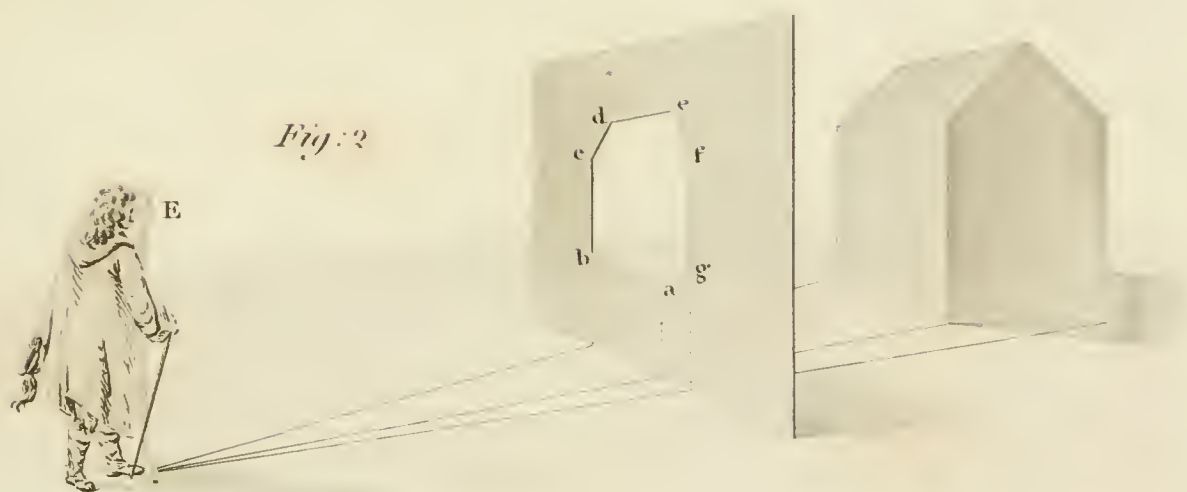
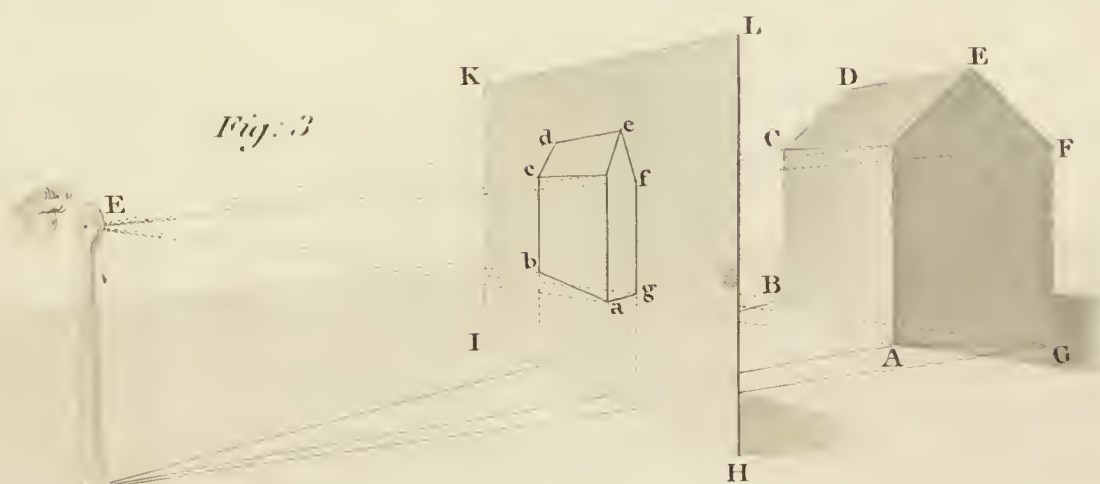


Fig: 3



As it is certain that the apparent figure of every object is changed by any variation of the place of the eye, situation of the object, or position of the intervening plane on which the representation is required; it of consequence follows, that to give a perspective delineation of any object, the POINT OF VIEW must be fixed, the position and place of the PLANE OF DELINEATION must be determined, and the situation and dimensions of the ORIGINAL OBJECT, known. With this data premised, a perspective delineation of any object, or multitude of objects, may be obtained, with such certainty and correctness, that the figures drawn, being cut out, and the plane on which they are delineated, fixed in its stated place, the original object or objects would be found to fit and fill the aperture, without the smallest possible variation.

DEFINITIONS.

4. POINT OF VIEW, or POINT OF SIGHT. Is the fixed place of the eye of the Observer, viewing the object or objects to be delineated.
5. PLANE OF DELINEATION, or PICTURE. Is the plane of canvass, or paper, upon which the delineation is made, or intended to be drawn.
6. ORIGINAL OBJECT, or OBJECTS. Is any object or objects, to be drawn; as a house, a ship, a man, or all, or many of them, together.
7. ORIGINAL LINES. Are any lines that are the boundaries of *Original Objects*, or of planes in those objects.
8. HORIZONTAL PLANES. Are any planes placed truly level; that is, to which the gravity of the plumb-line is truly perpendicular.

The floors, ciellings, &c. of every house are endeavoured to be made horizontal, and are always so considered in perspective delineations of regular Buildings.

9. HORIZONTAL LINE. In perspective, is a line on the *plane of delineation*, level with the eye of the observer or *point of view*; and is supposed obtained by an horizontal plane passing through the eye of the observer, produced till it cuts the *plane of delineation*.

10. VERTICAL PLANES, Are planes perpendicular to *Horizontal Planes*.

The upright walls of a house, its doors, windows, &c. are always considered to be truly vertical, being ever endeavoured to be made so.

Let it be required to find the perspective representation of a cube, supposed placed perpendicularly over the square A B C D, Fig. 1. Plate 6, as it would appear on a plane of glass standing vertically on the line G L, to the eye of an observer, elevated one inch and a half over the station point, S.

Draw SG parallel to AB , and SL parallel to AD ; also draw the visual rays SA, SB, SC and SD ; produce the line BA till it touches the line GL in the point I , and draw SO perpendicular to GL . Then, on a plane of paper or canvass as GHL , Fig. 2, draw a line VZ , parallel to GL , and make it one inch and a half above GL ; VZ will be the horizontal line. Mark a point at V , and another at Z , as far distant from each other, as are the points G and L in the plan, Fig. 1. Take the distances $G a, G b, G c$ and $G d$, where the visual rays intersect the line GL (Fig. 1.) severally in your compasses, and mark them off on the line VZ (Fig. 2.) at 1, 2, 3, and 4, and draw fine perpendicular lines through the points. Take the distance GI (Fig. 1.), and mark it off at VI (Fig. 2.) and draw a vertical line through the point I ; upon which line mark the height of the cube, equal to the length of one of its sides, in the plan, as OP . Then are all the necessary steps taken for obtaining the representation required; which is done by drawing the lines OV and PV (Fig. 3.) aZ and cZ ; fV and eZ , cutting each other in the point d , and completing the figure $abcdfg$. Which figure will be the representative figure of a cube, as it would appear to an observer regarding it situated on the square $ABCD$, (Fig. 1.) whose eye was one inch and a half above the point S .

If the drawing upon the plane GHL (Fig. 3.) was placed perpendicularly over the line GL , as is done (Fig. 4.) by turning the moveable plane GHL upright on the line GL , the relation it then has to the ground plan will be more clearly discernable, and the united operations and coincidence of both, more readily seen; and where it may be noticed that were the figure $abcdfg$ cut out, a solid cube standing on the square $ABCD$, would appear exactly to fit the aperture, to the eye of a person elevated, one inch and a half over the point S , with his eye opposite the point O in the horizon.

D E F I N I T I O N S.

11. GROUND PLANE. Is the plane upon which the *Objects* to be drawn are placed; as also whereon stands the *Observer* and *Plane of Delineation*.

N. B. The *Ground Plane*, in perspective enquiries, is considered an infinitely extended level, or horizontal, plane.

12. GROUND LINE. Is the line in which the *Plane of Delineation* rests on the *Ground Plane*.

13. STATION POINT. Is a point on the *Ground Plane* perpendicularly under the *Point of Sight*, or *Point of View*.

In the process of perspective delineations, the horizon, or horizontal line, is a consideration of the greatest importance, inasmuch, as it regulates

Fig. 1.

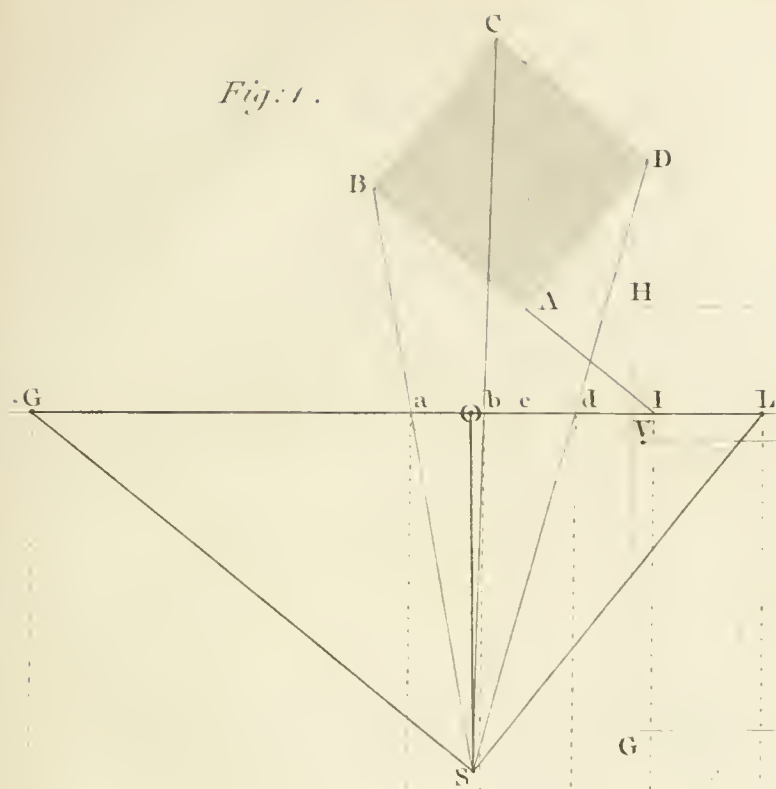


Fig. 3.

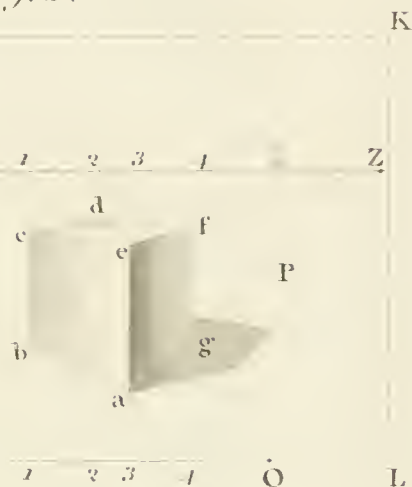


Fig. 2.

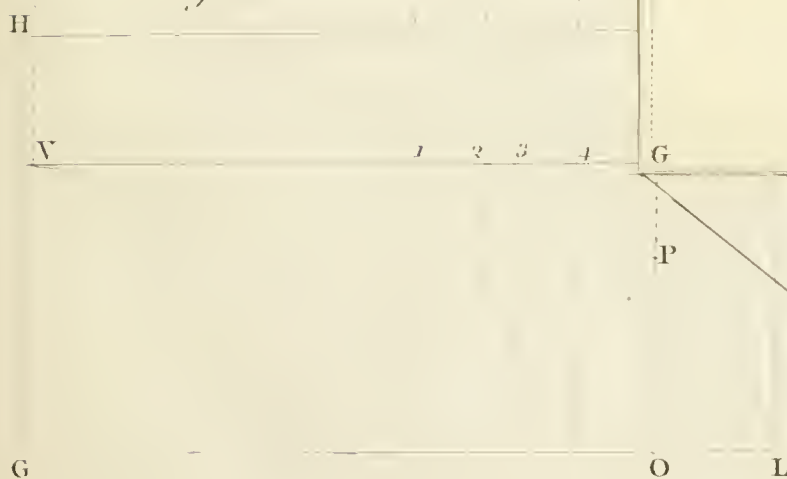
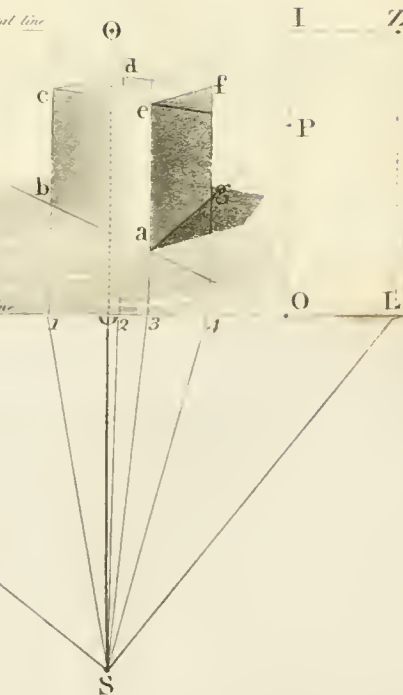


Fig. 4.

Horizontal line

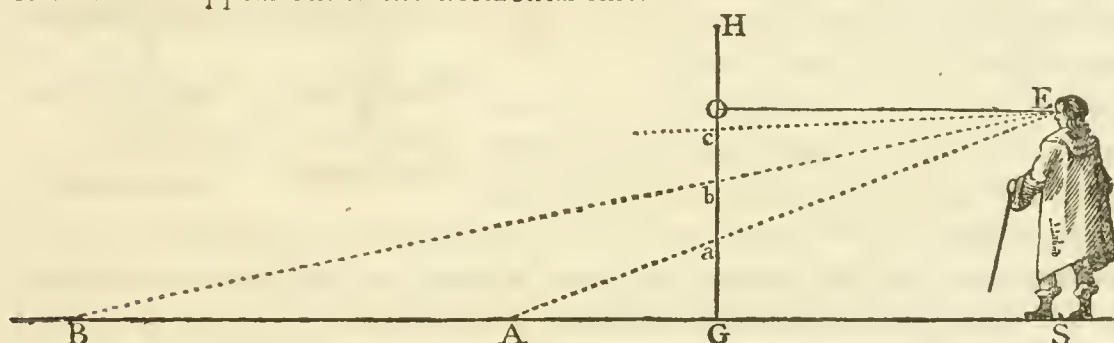
Ground line





and governs every part of the work, whether it be the representation of buildings, or human figures, or both, or with numerous other objects combined. Accordingly as the *horizontal line* is placed higher or lower, does the drawing of the whole picture vary, the entire of the work being governed by it.

Between the *Horizontal line* and the *Ground line*, or bottom edge of the Picture, is comprehended the representation of infinity of level ground; that is, were the *Ground plane* to be infinitely stretched out, beyond the plane of delineation, it would all appear under the horizontal line.



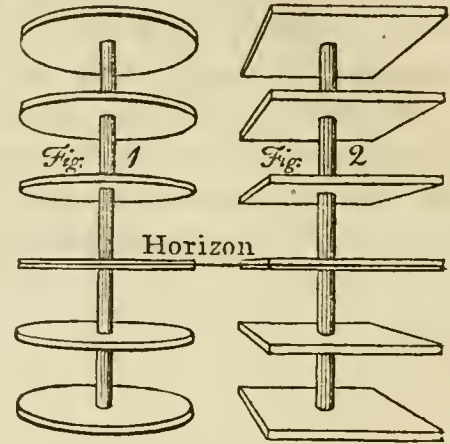
Let the line A S represent a section of the ground plane; and let G H represent a section of the plane of delineation; let E be the place of the eye of an observer; S will, of consequence, be the station point. Draw the line E O parallel to A S, cutting the line of the picture G H, in the point O, the place of the Horizontal line; *then will the space between G and O, on the picture, or plane of delineation, be the representation of the level ground plane, continued infinitely towards B, beyond the plane of the picture.*

The space of ground from G to A, is a certain distance; by drawing the visual ray A E, the plane of delineation is cut in the point *a*, giving the space *a G* for its representation on the picture. Suppose the representation of a greater length were required, as G B; the visual ray B E being drawn, determines and gives *b G* for its representation on the picture; and so on of any length that might be required, it would always be obtained by drawing a visual ray from the distance desired, to the eye, cutting the picture; but no point on the ground line could be so far distant, that a visual ray from it could fall in with the line O E, because the line O E is parallel to the ground line. Did the line of visual ray, as E *c*, differ but ever so little from the line O E, it would if produced, somewhere cut the ground line S B, lengthened out; but no point, however far distant, could be assumed in the ground plane, that a visual ray from it could fall in with the line O E; because two parallel lines, though produced infinitely, could never meet;

wherefore the space between G and O, as was advanced, comprehends the representation of infinity of level space under the horizon.

When any level plane is below the horizon, then the top of it is seen; the more it is depressed below the horizon, the more is its true figure discernable; as also will be the case the more it is elevated above the horizon; and when a level plane is in the plane of the horizon, then is its appearance but a right line; as is expressed in Figures 1 and 2.

From what has been before observed of two equal heights, one placed nearer the eye of the observer than the other, that the nearer height appears higher than the farther; it will of consequence follow, that if a square plane or parallelogram, as the front of a house, be placed before an observer, one end nearer the eye than the other, that in consequence of the nearer vertical angle appearing higher than the farther, the horizontal lines of the top and bottom will appear to decline towards one another, on the side of the farther angle; and must of course, if continued in the representation, meet in a point. These points of union or meeting of inclined lines, have been denominated by the best writers on perspective, the vanishing points of those apparently inclined lines.



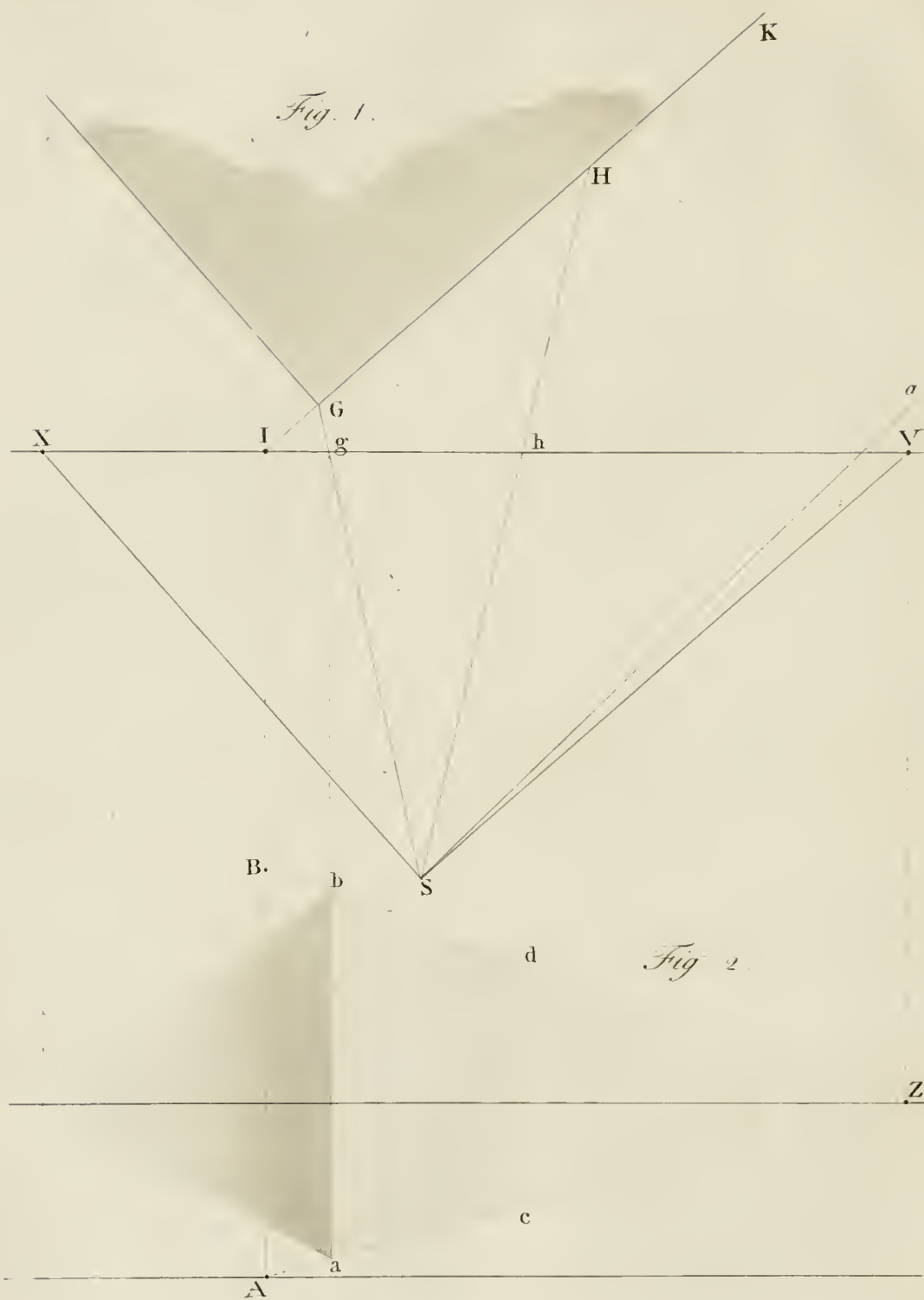
D E F I N I T I O N S .

14. VANISHING POINT, Is a point on the plane of Delineation, which is the point of union or point of convergency that two or more lines will have, which are the representations of two or more parallel lines in an original object, placed inclined to the plane of delineation.

This definition and the following (the 15th) and all the observations relating to them, should be carefully and thoroughly considered; as the justly understanding of them is matter of the utmost importance: 'tis therefore, that the Student is requested to be particularly earnest in the consideration of them, and if not fully comprehended on a first perusal, to read them over again and again, and ponder on them, till they are thoroughly conceived.

15. VANISHING LINE, Is a line on the picture, or plane of delineation, supposed obtained by a plane passing through the eye, *parallel* to any plane in an original object, and produced until it cuts the picture.

Consequently the *Horizontal line* is the *Vanishing line* of all horizontal planes; and all horizontal lines, or lines laying in horizontal planes, will have their *vanishing points* in the *horizontal line*.



And the *vanishing points* of all lines whatever, will be somewhere in the lines that are the *vanishing lines* of the planes those lines are in.

And farther, all parallel lines in an original object or objects, that are situated *parallel* to the plane of delineation, can have no vanishing point, but must all, as are the originals, be drawn geometrically parallel, on the plane of delineation.

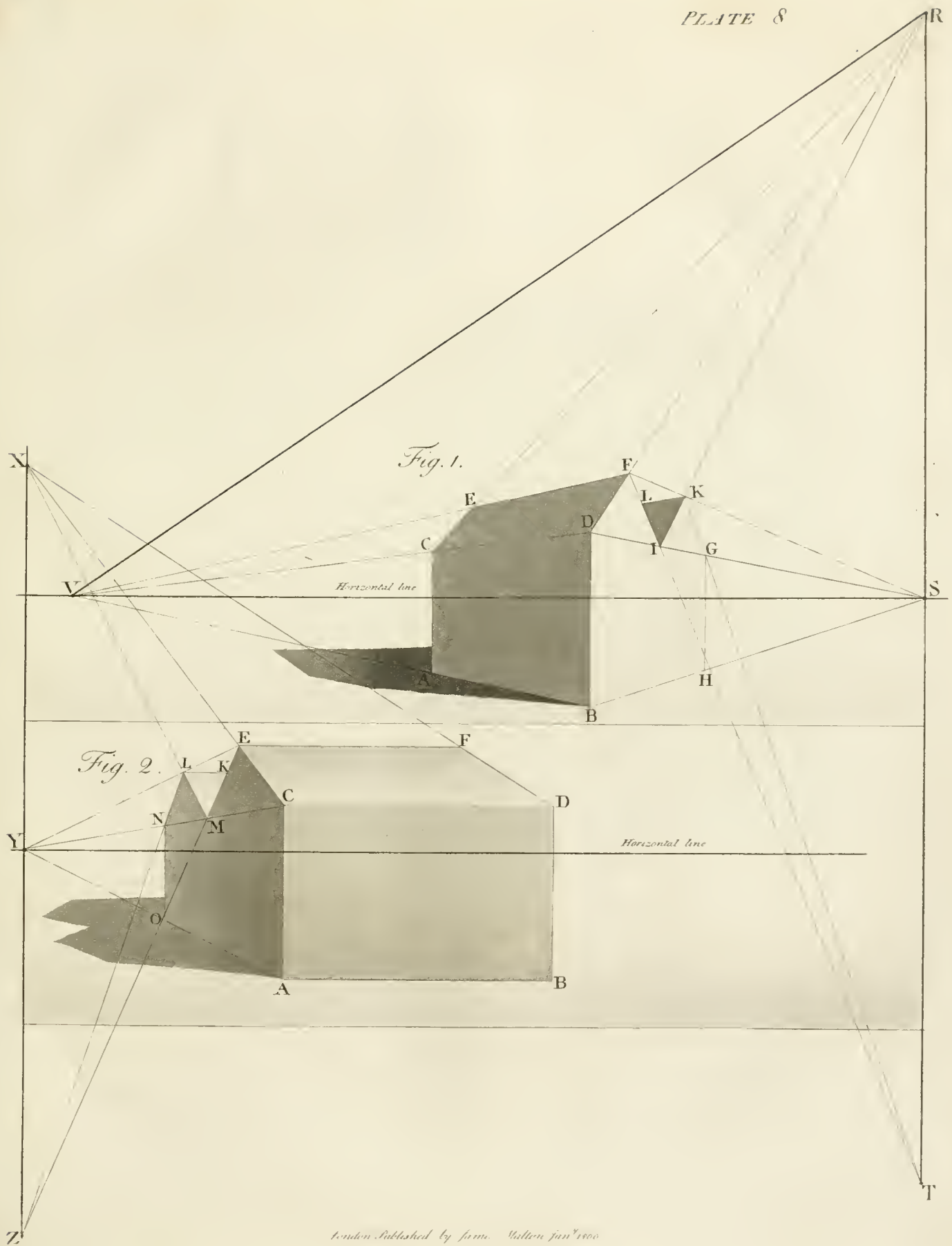
To find the vanishing point of a line, inclined to the plane of delineation; draw a line from the eye of the observer, parallel to the line of which the vanishing point is required, till it cuts the picture or plane of delineation; the point wherein it touches the picture is the vanishing point of that original line, and of all lines parallel to it.

Let the line GH (Fig. 1. Plate VII.) be the direction of a front of a building on the ground plane, standing inclined to an observer at the station S; and let the line XV be the direction of the plane of delineation; draw SV parallel to GH; also draw the visual rays SG, SH. It must be clearly evident that the angle of the front of the house, standing perpendicularly over the point G, will appear higher than the equal height at the farther angle, over the point H; of consequence, the top and bottom horizontal lines of the building will appear inclined, and to have a tendency towards each other on that side where the upright angle appears the lesser, and therefore must be so represented on the plane of delineation. The point wherein they would meet, if produced, would be a point in the horizontal line perpendicularly over the point V in the ground line, at the height of the eye of the observer, as is expressed by the point Z, in the Diagram below, (Fig. 2.) and which point is obtained by being the intersection of a line drawn from the eye parallel to GH, (Fig. 1.) produced till it touches the plane of delineation XV, in the horizon at V. *Which point would be the point of their tendency, and comprehends infinity of space between it, in the horizon, and the point I, the intersecting point of the line GH produced till it cuts the ground line.* The angle G will appear to intersect the plane of delineation in the point g; and the angle H will appear to do the same in the point h; and the apparent height of each, according to any fixed height of the building, is determined as in the diagram below. Where, the height being set up on the intersecting line of the building, AB, and lines being drawn from those points to the vanishing point Z, determines the heights ab and cd, as the apparent and comparative heights of the two extreme angles of the building; and the whole plane, were it continued on infinitely, would centre and vanish in a point; as at Z.

For however extended might be the line $G H$ towards K , a visual ray could not be drawn from any point of the extended line $G K$ that could possibly fall in with the line $S V$, because the line $S V$ is parallel to $G K$. Wherefore the space from I to V , is the representative space on the plane of delineation, for the infinite extension of the plane over the line $G K$. How trifling soever might be the variation of the visual ray, as $S a$, from the line $S V$, were $S a$ produced, it would somewhere meet the extended line $G K$, which could not be the case with the producing of the line $S V$, because it is parallel to $G K$; and parallel lines, though produced infinitely, will never meet.

A full illustration of all the foregoing observations and conclusions will be found on survey of the figures, Plate 8, where may be observed (Fig. 1) that the lines $A B$, $C D$, $E F$, and $L K$, being the representations of parallel lines, the originals of which were in planes inclined to the plane of delineation, have the same vanishing point, V ; and being the representations also of horizontal lines, have their *vanishing point* in the *horizontal line*. The lines $F K$, $D G$ and $B H$, being also the representations of parallel lines, have likewise a common point of tendency, or vanishing point, S ; and, as before, being all horizontal lines, have their vanishing point in the horizontal line, which is the vanishing line of all horizontal planes, consequently all lines laying in horizontal planes have their vanishing points in the horizontal line. Upon the same reasoning the lines $C E$, $D F$ and $I K$, being also the representations of parallel lines, have, in consequence, a common vanishing point, as R ; and the parallel lines $F I$ and $K G$, have a like mutual tendency in the point T . But it may be remarked that the horizontal lines $F K$, $D G$ and $B H$, and the inclined lines $D F$, $I K$ and $F I$ and $K G$ are lines all in the same inclined plane $B D F I K G H$; wherefore, agreeably to the principles before stated, that the vanishing points of all lines laying in the same plane, will be somewhere in the vanishing line of that plane; those three different inclinations of lines will have their vanishing points in the same right line: such may be observed is here the case. The line RST is the vanishing line of the plane $B D F I K G H$; being the line that would be obtained by a plane through the eye parallel to the original plane, of which that is the representation, and producing it until it would cut the picture, and the three vanishing points of the three different directions of the lines in that plane, are all in that line, as R , S and T .

The line RST is not the vanishing line of the plane $B D F I K G H$ only, it is the vanishing line also of all planes parallel to that plane; and is there-



fore the vanishing line of the parallel end of the same house, and all lines laying in that plane will have their vanishing points somewhere in that line; such is the case with the line C E, which has its vanishing point at R; for the lines C E and D F, are parallel lines, and though the boundaries of different planes, they are also in the same plane, D C E F; and will therefore have a common vanishing point; which they have, at R.

Fig. 2. is another representation of the above object, but with this difference of position, that one plane of the house is considered as having been placed parallel to the plane of delineation; wherefore the lines A B, C D, E F and L K being all parallel to the plane of delineation, will have no point of declination, or common tendency, but will all be drawn geometrically parallel to each other. But the lines L E, N C and O A being perpendicular to the plane of the picture, because at right-angles with the others, will have their point of tendency directly opposite the point of view, or point of sight; because, on the principle of finding the vanishing point of lines, by a line being drawn from the eye, to the picture, parallel to them, it will of course be there, as at Y; and a vertical line through Y, will be the vanishing line of the plane O N L M E C A. The slant lines of the roof F D, E C, and L M, being parallel, though in different planes, will have a point of common tendency in the same vanishing line, as X; as will also the parallel lines L N and E M, at Z.

Thus I have brought the investigation of my subject to an end; and shall here conclude what I may term a whole, but brief theory, of perspective delineation on planes. I do not however imagine it will be thoroughly comprehended, on a first perusal, by those who were before totally unacquainted with the subject; nor do I consider it will on a second, without some practice; but which, I make no doubt, before having gone through the following work of practice, will be clearly and fully understood.

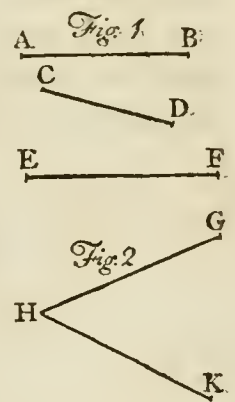
PRACTICAL GEOMETRY.

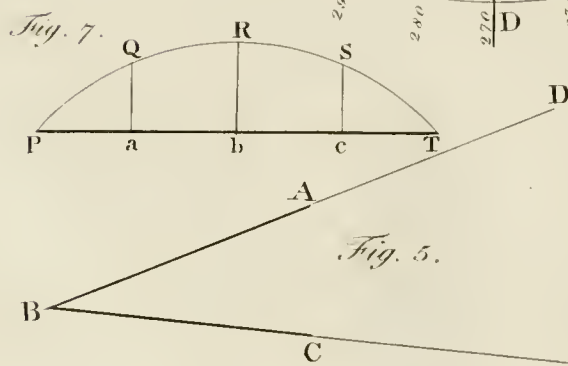
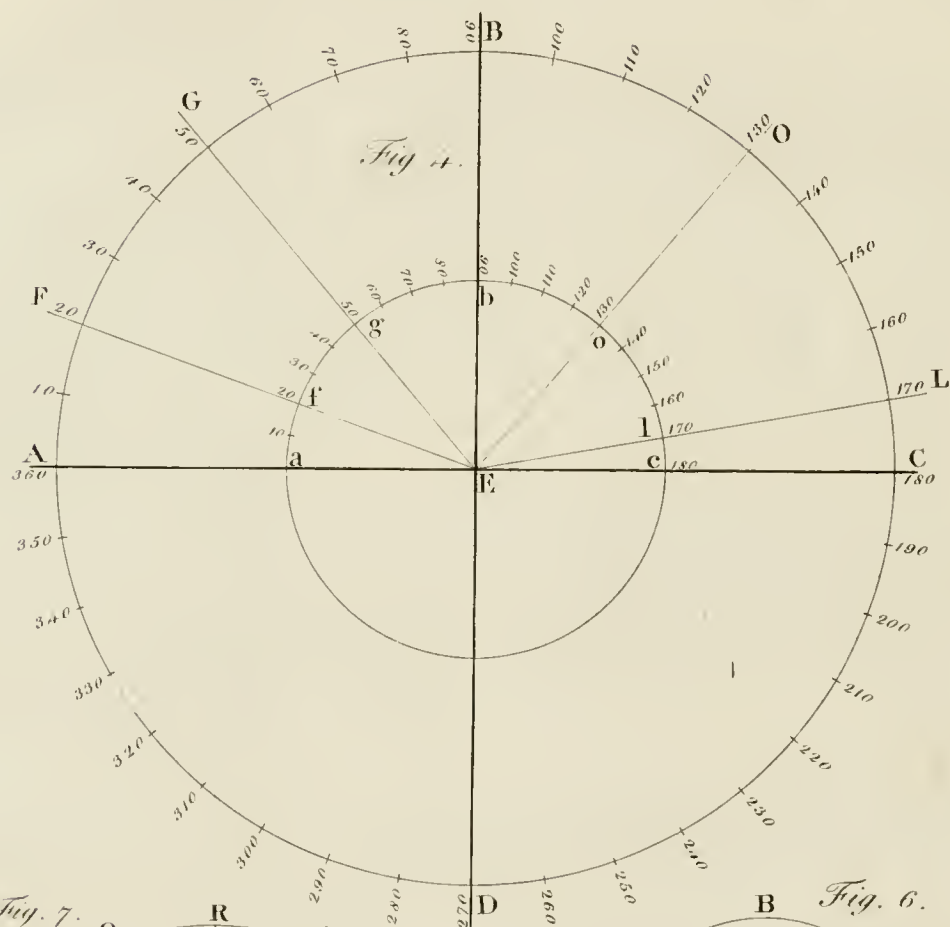
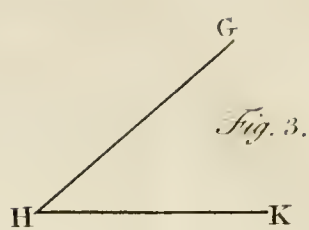
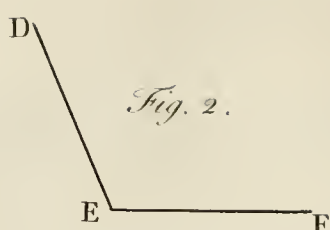
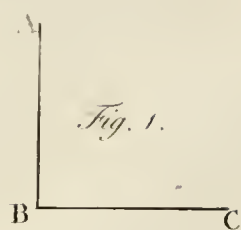
PREVIOUS to entering on the Practice of Perspective Delineation, it is requisite that the student be acquainted with a sufficiency of practical geometry, to be enabled to execute, without delay, what may be required in the process of perspective drawing. In this section have been collected such problems on that subject as are absolutely necessary; they are of general use, and the most facile construction of them has been carefully endeavoured. Should practical geometry be already familiar to the reader, this division may be passed, only performing the last requisition, as it contains the principal preliminary steps relative to the operative lines for finding the perspective forms of objects from determined stations.

To know something of angles, their kinds, how to estimate their magnitude, and compare them to each other, is not only requisite in most mathematical researches, but of advantage even in the common purposes of life.

By an **ANGLE**, in geometry, is meant the inclination, or the mutual tendency, which two lines have to each other that touch at one extreme, and then separate, leaving a space between them.

Mathematicians refer to a line, or to many lines, by letters, or other symbols, being placed at their extremes; and identify them, by calling them the lines of such symbols or letters; as of the three lines, Fig. 1, which may be denoted the lines AB, CD, and EF. By this simple means distinct reference is made to different lines where many are confusedly mixed together; and inferences and consequences are drawn relative to them, with the utmost perspicuity and exactitude; as of the three lines AB, CD, and EF; asserting, that if the line AB is longer than CD, CD is also shorter than EF, EF being longer than AB. Or, it may be said, that the line AB is parallel to EF, and that CD is inclined to them both. An angle is referred to by three letters, or other symbols; one being placed at the vertex, or junction of the two lines forming of it; as H, Fig. 2, and one at each other extreme of the lines, as G and K; to nominate which angle, and convey a sense of the same to others, it is read the angle GHK, or KHG, always naming the letter at the vertex of the angle, between those which refer to the other extremes of the lines.





Angles, formed by right lines, are of three kinds only; *viz.* Right Angles, [Plate 9.], Obtuse Angles, and Acute Angles. When one of the lines forming of an angle is perpendicular to the other, then is such an angle said to be a right angle; such is the angle ABC , Fig. 1, Plate 9, the line AB being perpendicular to the line BC . When the lines have a greater degree of expansion than a right angle, such an angle is said to be an obtuse angle, as the angle DEF , Fig. 2; and when they have a less degree of expansion than a right angle, such an angle is said to be acute, as the angle GHI , Fig. 3.

The magnitude of an angle is computed by the portion it comprehends of a circle, using the angular point as the centre to revolve the circle upon. For the general admeasurement of angles, the circumference of a circle is divided into 360 equal parts, called degrees; a division universally assented to; and an angle is said to contain, or to be an angle of as many degrees as fall within the expansion of the two lines.

If two lines, one perpendicular to the other, cross each other, there are formed four angles, all right angles. By the crossing of the perpendicular lines AC and BD , (Fig. 4.) there are formed four right angles, and using the point of their common intersection, E , as the point to revolve a circle around upon, each angle will of course contain a quarter of that circumference; and the whole circumference being divided into 360 equal parts, each right angle, (all right angles being equal,) must contain a quarter of 360, that is 90 degrees. A right angle is a determinate one, and there can be no variety of them; but of obtuse and acute angles there may be many, of various magnitudes.

The circle $ABCD$, Fig. 4, is divided into 360 equal parts. The angle AEF , is an acute angle of 20 degrees; the angle AEG an acute angle of 50 degrees; and so on to any number short of 90. The angle AEO is an obtuse angle of 130 degrees, and the angle AEL an obtuse angle of 170 degrees, and so on to any number short of 180, at which period the expansion of the two lines would fall into one right line, as AEC . For the greater accuracy, in the estimating of angles, each degree is subdivided into 60 equal parts, called minutes; and each minute into 60 equal parts, called seconds; so the measurement of an angle may be a certain number of degrees, minutes, seconds, thirds, &c.

An angle is not enlarged by lengthening of the lines forming of it; for the angle ABC (Fig. 5.) is still the same and not at all increased by extending of the lines to D and E . An angle is estimated only by the degrees of incli-

[Plate 9.] nation which one line forming it has to the other ; and that inclination is not increased by lengthening of the lines ; for the line DB has no greater, but the same inclination to AB that any portion of the line has ; and the angle DBE and ABC are one and the same angle, and would still be so were the lines lengthened out infinitely.

This may be more clearly perceived in Fig. 4, where the angle aEf is the same with AEF ; and aEg with AEG, &c. For, each contains similar portions of the curve of their respective circles ; consequently an equal number of degrees. By attentively examining the figure, it will be fully comprehended that the magnitude of angles is affected only by the degree of inclination which the lines have to each other, however short they are, or however long.

It is not my intention to give a complete system of Practical Geometry ; that would form an extensive work of itself. I purpose to give only that sufficiency of it as will enable the Student in Perspective to draw his figures on true principles, and correctly.

A POINT may be defined to be the extremity of a line ; a LINE, curved, or straight, the extremity of a surface ; and a SURFACE, plane, or irregular, the boundary of a solid.

A RIGHT LINE, is the shortest line that can be drawn between two extreme points. A CURVED LINE, is a line that lays indirect between its extreme points. Lines are said to be PARALLEL when the perpendicular distance between them is in every part equal. Curved lines are parallel when they are opposite portions of concentric curves ; and CONCENTRIC CIRCLES are such as are struck upon a common center ; as are the circles ABCD, EFGH, IKLM, Fig. 6. being struck upon the common center O. In which circles, the portions BC, FG, and KL, are parallel.

An ARC is any portion of a circle, as the arc PQRST, Fig. 7.

A CHORD of an arc, is a right line drawn from one extent of an arc to the other, as the line PT of the arc PQRST, Fig. 7.

An ORDINATE, or ORDINATES, is a line, or any number of lines, dropped from an arc, or curved line, perpendicularly to the chord of that arc, or curved line, as the lines Qa, Rb, Sc, Fig. 7. which are dropped from the curve PQRST perpendicularly to the chord PT.

An ANGLE has already been defined ; page 18.

PROBLEM I. To make an angle equal to a given angle, from a given point, [Plate 10.] in a given line.

ABC, [Prob. 1. PLATE 10.] is the given angle, and E the given point in the line EF^a.

With one leg of the compasses fixed on the vertex B, of the given angle, with the other describe the arc AC; with the same extent of compasses, and with one leg fixed in the given point E, describe the arc, FD, indefinite; then extend the compasses from A to C, and apply that measure from F to D, making the arc FD equal the arc AC; draw the line ED, then will the angle DEF, be equal to the angle ABC.

Note. For greater accuracy in measuring, or making equal angles, let the expansion of the compasses be as great as the angle to be measured, or the compasses will well allow.

PROB. II. To draw a line from a given point, parallel to a given line.

GH is the given line, and I is the given point.

From the given point I, draw a line as IH at pleasure, touching the given line, in a point at H; make the angle HIK, equal the angle GHI, by Problem I, and the line IK will be parallel to the line GH.

PROB. III. To bisect, or to divide, a given line into two equal parts.

LM is the given line.

With an extent of compasses greater than half the given line, on each of its extremes L, and M, describe two arcs crossing each other in the points a and b; draw the line ab which will bisect, or divide the line LM into two equal parts.

PROB. IV. To bisect, or divide, any given angle into two equal divisions.

NOP is the given angle to be divided.

On the vertex O of the given angle, describe an arc, as NP; with the same or any extent of compasses greater than half that arc, on the points N, and P, describe two arcs intersecting each other at c; then draw the line Oc, which will bisect the angle NOP.

DEFINITION. A right line is said to be perpendicular to another right line when it does not incline to either side, but makes a right angle on both sides of the line. And this, be the two lines posited as they will, without regard to what is really horizontal or vertical.

^a Throughout these Problems, the given requisites, such as lines, angles, &c. are drawn with stout lines; the operative lines, or lines of the process, are all dotted; and the required lines, or the lines obtained, are expressed by fine lines.

[Plate 10.]

PROB. V. To draw a right line perpendicular to a given right line, from a given point in that line.

RS is the given line, and T is the given point.

On each side of the given point T, set off equal measures, as TR, and TS; then, with any greater measure in the compasses, on the points R, and S, describe two arcs intersecting each other in the point d; draw the line dT, which will be perpendicular to the line RS.

PROB. VI. At the extreme point of a given right line, to draw another right line perpendicular to the given line.

VX is the given line, and X the given point.

Assume any point, as the point e, at pleasure, but let it be somewhere about midway between the line given and the line required, and fixing one leg of the compasses in that point, extend the other to the point X, from whence the perpendicular is required, and draw the curve VXZ indefinite; then applying a ruler to the points e, and V, where the curve touches the line VX, draw the right line VeZ, touching the other extreme of the curve in the point Z, and draw the line XZ which will be perpendicular to the line VX.

The foregoing proposition is a very useful one, and worthy of particular consideration. If from each extreme of the diameter of a circle, lines be drawn meeting in the circumference, the angle that would be formed, would be a right angle; and of consequence the lines one perpendicular to the other. Thus in the semicircle ABCDE, Fig. 7, if two lines AB and BE, be drawn, meeting in the point B, the angle made, the angle ABE, will be a right angle: also the angle ACE is a right angle, so is the angle ADE; and so would any angle be which extended the diameter, and whose vertex touched the circumference.

In Problem VI. before performed, the curve VXZ is a semicircle, of which VZ is the diameter; and the angle VXZ is an angle extending the diameter, and whose vertex touches the circumference, consequently the angle VXZ is a right angle.

PROB. VII. To draw a line perpendicular to a right line, from a given point out of that line.

FG is the given line, and H is the given point.

On H, the given point, with any opening of the compasses greater than the distance of the line, draw an arc, as FG, cutting the given line in the two points

F and G. Then with the same, or any opening of the compasses greater than half the space between the two points F and G, describe two arcs on the other side of the line, intersecting at f, and draw fH, which will be perpendicular to FG. [Plate 10.]

PROB. VIII. To divide a line proportionally, as another is divided.

IK is the line required to be divided in the same parts, proportionally, as is the line LM in the points g and h.

Place the two lines parallel to each other, and at any distance at discretion, as IK; draw the lines LI and MK, touching the extremes of the given lines, and produce them till they meet in the point N; then draw the lines hN and gN, cutting the line IK in the points i and k, the points required. The divisions made on the line IK will be proportionally to each other, and to the whole line, as are the divisions in the line LM, to one another, and to the whole line.

DEF. A SQUARE is a Quadrilateral whose opposite sides are equal and parallel, and its four internal angles all right ones.

PROB. IX. To construct a Square on a given line. OP is the given line.

On either extreme of the given line, O or P, suppose O, draw a perpendicular line, as OR, (Prob. VI) make the line OR equal to the line OP, and with the same measure in the compasses, on the points P and R, draw two arcs intersecting each other at S; then draw the lines SR and SP, which will complete the Square ORSP.

DEF. A REGULAR HEXAGON, is a six equal sided right lined figure, having six internal angles, which should also all be equal.

PROB. X. To construct a regular hexagon on a given line, for a side.

TV is the given line, for a side of the hexagon.

On the two extremes of the given line T and V, with the length of the line TV in the compasses, describe two arcs, as TmW, and VmZ, intersecting each other at m; on which point m, with the same measure in the compasses, describe the circle TZXYWV, and still with the same measure, on the points Z and W, mark the circle in the two other points X and Y, and draw the lines TZ, ZX, XY, YW and WV, which will complete the hexagon TZXYWV.

Note, a side of a regular hexagon, is the chord of the sixth part of the circumference of a circle circumscribing of it.

DEF. A REGULAR OCTAGON, is an eight equal-sided, right lined figure, having eight internal angles, which should also all be equal.

[Plate 10.] PROB. XI. To construct a regular octagon, on a given line, the dimension of one of its sides.

AB is the given line for the side of an octagon.

Produce, or lengthen, the line AB, both ways, towards I and K, and on the points A and B, draw the perpendiculars AE and BF indefinite (Prob. V.) Bisect the right angles EAI and FBK (Prob. IV.) by the lines AC and BH, which lines make each equal to the given side of the octagon AB. Draw CD and HG parallel to AE and BF, and make them also each equal to AB; lastly, make the lines AE and BF, each equal to CH, and draw the lines DE and FG, which will complete the octagon A C D E F G H B.

As an octagon is a figure of very frequent occurrence in buildings, often forming the ground plan of apartments, and, as commonly as the circle, shaping the bows or projecting ends and sides of rooms; I have desired therefore, to give as correct and expeditious ways of constructing it, as possible, and probably the following may be found more so, than the one just described, when such method can be followed.

Note.—It often happens that an octagon is required to be constructed in a given space, that is, its diameter or breadth is given, and not a side. When that is the case, the business is soon accomplished, by first making a square of the diameter, and proceeding as follows.

PROB. XII. To construct an octagon on a given line, its diameter or breadth.

LO is the given line for the diameter of an octagon.

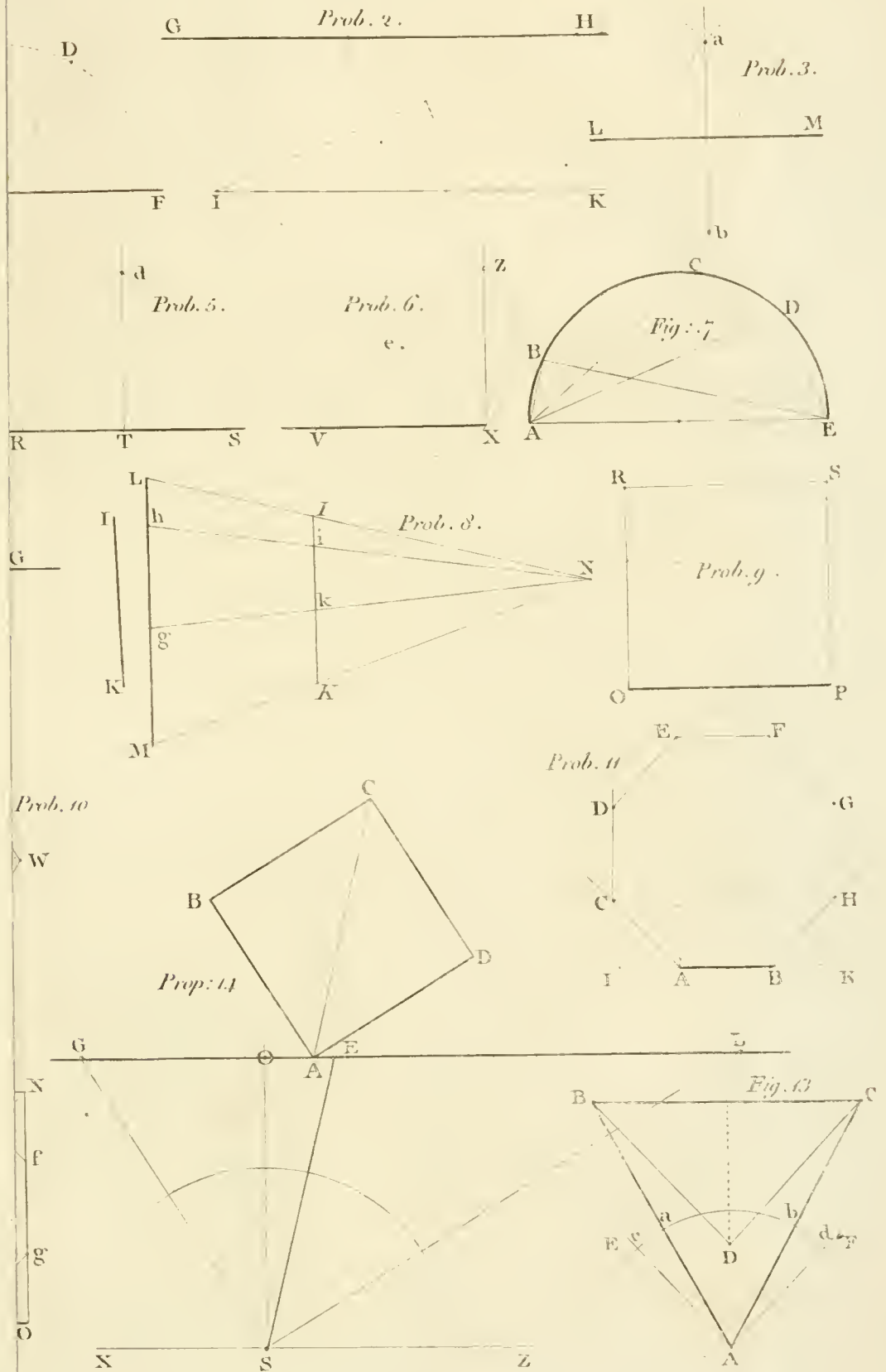
On the given line LO first construct a square (Prob. IX.) as LMNO, and draw the diagonals LN and MO, intersecting each other in the point k; then on the four angles of the square, with the measure of one half of a diagonal in the compasses, describe the four arcs ckh, bke, dk g, and fka, cutting the sides of the square in the points abcdefg and h; lastly, draw the lines ab, cd, ef, and gh, which will form and be sides of the octagon required, a b c d e f g h.

If from any point within a triangle, two right lines are drawn to the extremes of any side of that triangle, those lines form a larger angle than the remaining two sides of the triangle.

In the triangle ABC, (Fig. 13) let a point, as D, be assumed, and draw the lines DB and DC; then will the angle BDC, be greater than the angle BAC. By drawing the lines AE and AF, respectively parallel to the lines DB, and DC, the circumstance will be manifest, for the angle EAF is equal the angle BDC, the lines being parallel; but the angle AEF is greater than the angle BAC, which expands but the portion from a to b of a circle measuring of it, while the other extends from c to d; wherefore the angle BDC, equal the angle EAF, is greater than the angle BAC; agreeably to the premises stated.

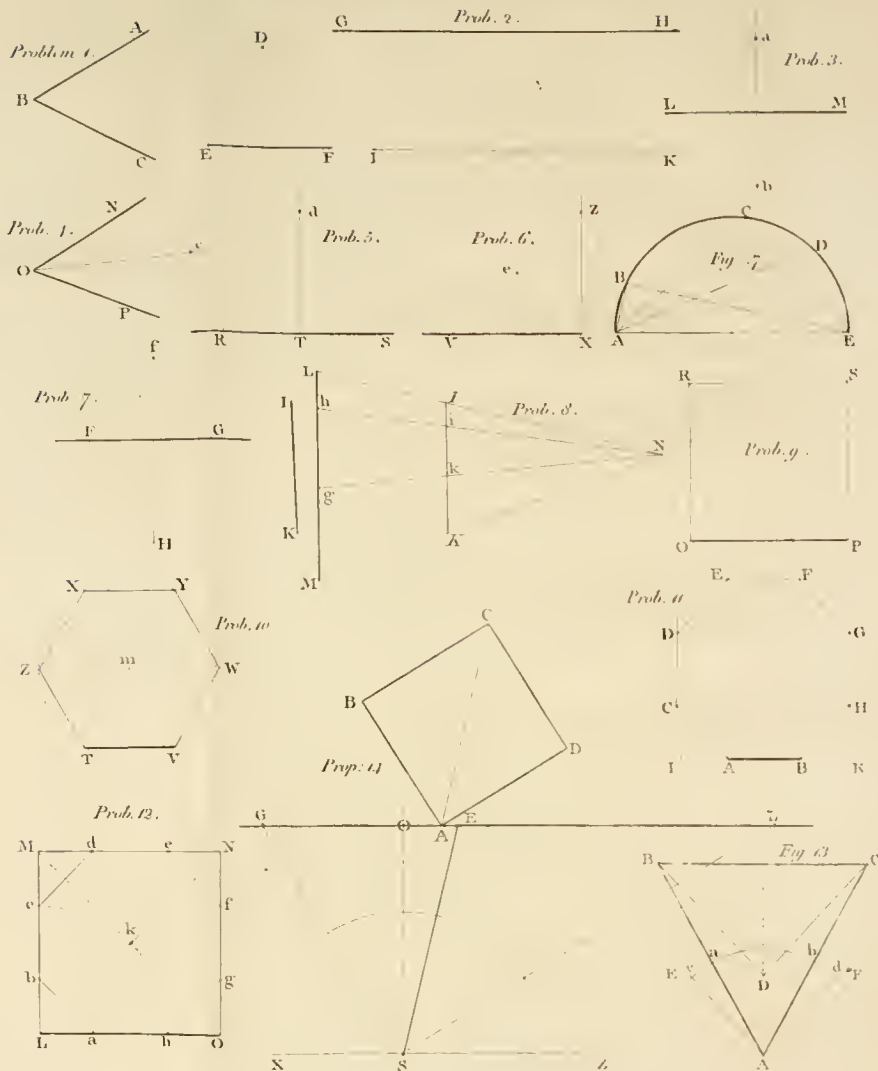
PRACTICAL GEOMETRY

PLATE X.



PRACTICAL GEOMETRY

PLATE X



These are all the geometrical problems I think necessary to the prosecuting of [Plate 10.] practical perspective delineations; should the student wish for farther, or more complete information, on this subject, I must refer him to the Work published by my Father, entitled, "A ROYAL ROAD TO GEOMETRY;" where will be found a complete body of Geometry, both elementary and practical, fully and clearly investigated; and also a comprehensive and brief theory of mensuration of superficies and solids, with some of the most commonly useful properties of the ellipsis or oval, pleasingly illustrated.

PROPOSITION 14. Draw the following perspective scheme.

As a confirmation of acquaintance with practical Geometry, and of the use of the compasses, it is required to draw the following scheme, which must be done with facility, as it is the previous step to drawing any regular perspective delineation, according to the practice of the following work.

On a given line, as AB , construct a square, as $ABCD$, (Prob. 9) draw a line GL , at pleasure, touching the angle A of the square. Through a point, as S , assumed on this side the line GL , draw a line, as XZ , parallel to the line GL . (Prob. 2). From the point S , draw a line as SO , perpendicular to the line GL . (Prob. 7). Also from the point S , draw the lines SG , and SL , severally parallel to the sides of the square, AB , and AD , by making the angles GSX and LSZ respectively equal to the angles BAG and DAL . (Prob. 1.) And lastly, draw the line SE bisecting the angle $GS L$. (Prob. 4). Which line will be parallel to the diagonal of the square, AC .

In the course of drawing perspective delineations of houses, &c. continual mention and reference must be made to plans and their component parts, with which the student will be considered to be well acquainted; but lest that should not be the case, it is necessary he be instructed as to what is meant and expressed in a plan of a building, and informed how the same is read by architects and others, acquainted with their indications.

A plan of a house is commonly explained or defined, as being the figure, marked out on the ground of the external boundaries, and internal divisions of the apartments of a building, either in actual existence, or intended to be built. In one respect such is a just definition, but in general, much more is expressed in plans than merely the situation, size, and figure, of the apartments; both to shew the proprietor what he is to expect, and that the builder may fully

comprehend what he is about to erect. A plan, as most generally drawn, is properly an horizontal section of a building at a stated height; or it is the figure, which the top of the walls would exhibit, when raised all to the same level a few feet above the ground, if looked at from above directly down upon them; whereby many incidents in the structure are expressed, that cannot be marked out in the trenches, or even take place, some four, five, or six, feet above ground.

[Plate 11.] This will be better understood by reference to sensible figures. To those who are conversant in Architecture, the Elevation (Fig. 1, Plate 11,) would be nearly pictured in the imagination from the mere inspection of the plan; Fig. 2; but the plan, Fig. 2, is not the figure that would be cut out in the ground, as shaping the foundation to the building; such would be simply as Fig. 3, expressing little more than the length and breadth of the apartments, and thickness of the walls, more information could not be gathered from it. Whereas, from the plan, Fig. 2, is understood that in front there are two pillars standing in a recess, with a door between them, and a niche in the middle of the pier on each side; also, that in each end of the apartment, within, there is a window, that there is a chimney in the middle of the cross-wall, with a door on the right leading into another apartment, and a recess for a false door on the other side the chimney, to be uniform with the real door; that the lines 1, 2, 3, 4, 5, &c. express an ascending flight of stairs; that A is the half-landing, on which there is a window to light the staircase, and that the dotted lines imply the returning flight to the next story: all which is clearly gathered and immediately understood from inspection of the plan simply, with other minute particulars; such as the number of steps that conduct into the dwelling, implied by the lines marked a, b, c, that they fall within the pillars, that there is intended a plinth around the building expressed by the double line around, that there is meant a base to the pillars, and such like minutia; and to the whole there is affixed a scale of feet, proportionally to the plan laid down, by means of which the dimensions, that is, the lengths and breadths of apartments, may be known, and the breadths of doors, windows, fire-places, stairs, and treads of stairs, &c. may be accurately measured.

Such delineation is undoubtedly an horizontal section of the walls, taken some six or seven feet from the ground; somewhere about the height of the line BC, Fig. 1. Indeed there are particulars expressed that cannot be noticed till the building is raised considerably higher, as the window D, on the

Fig. 1.



Fig. 2.

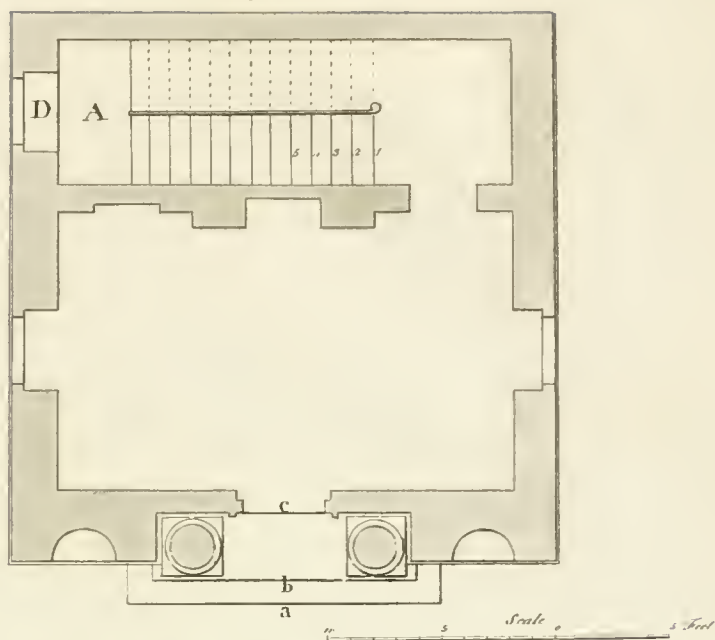


Fig. 3.

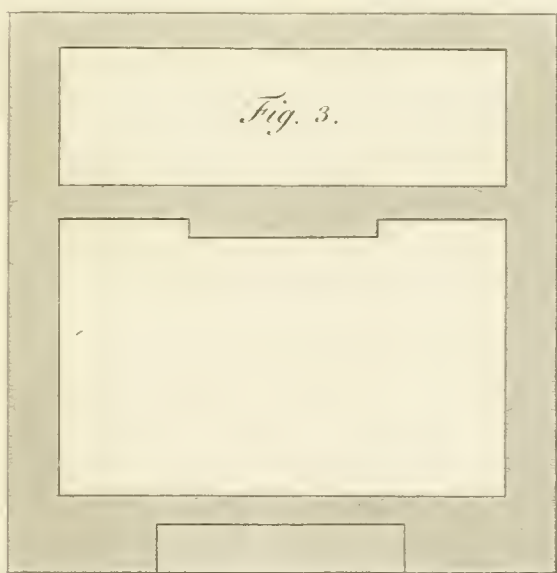


Fig. 4.

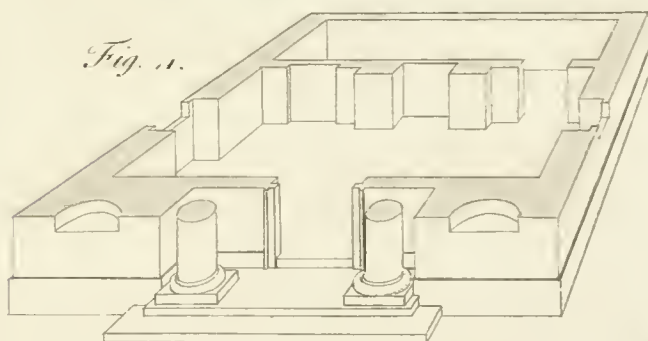


Fig. 5.

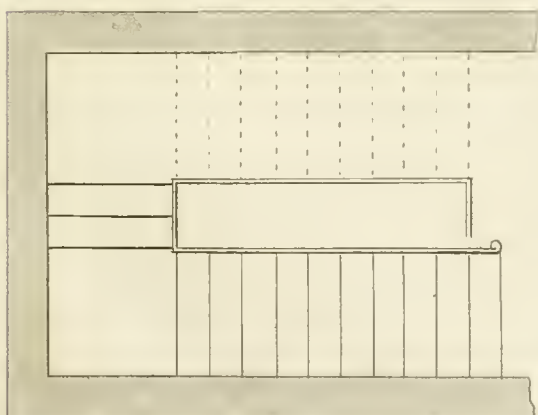
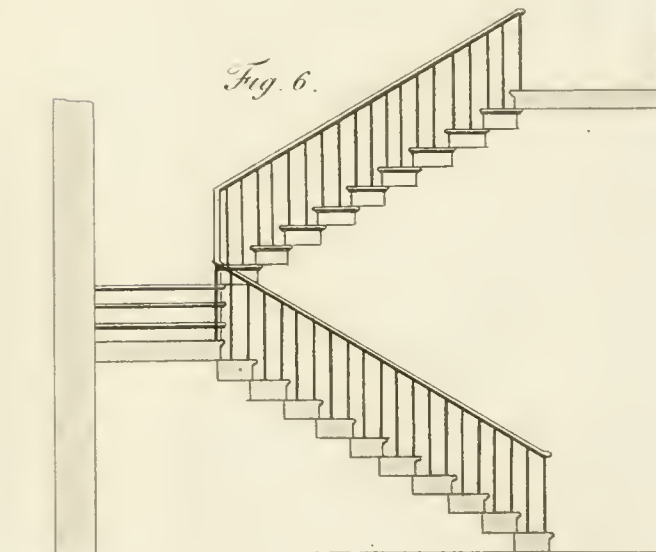


Fig. 6.



half landing, and the completion of the stair-case to the second story. [Plate 11.] All of which may still be better conceived from inspection of the perspective delineation, Fig. 4, representing the structure as raised some seven feet above the ground level, and of which the plan, Fig. 2, is the geometrical or ichnographical projection.

I have been thus particular to avoid all delay from the want of such necessary information; and for the more certain assurance of having no impediment to check advances, I will describe how a stair-case is read from its geometrical plan. Fig. 5, is the plan of a stair-case, shewing the space of ground it occupies, and the number and breadth of the steps. Fig 6, is the geometrical elevation of that staircase, shewing its relation to the plan, and the height and direction of the flight of steps to the story above, to which they conduct: the height of the steps is regulated to the height they are intended to mount to, and the breadth, to the convenience of the tread and the space allowed to contain the whole in.

PRACTICAL PERSPECTIVE.

IF the student has attentively perused the Introduction to this work, and fully comprehends it, he will be ably qualified to proceed to the practice of what is there investigated; at the same time he will enjoy the satisfaction arising from knowing perfectly what he is about to do, and of being convinced of the truth of the result. Should he have neglected, or from previous knowledge have no occasion for, that examination, he will here, merely have to perform as directed, placing implicit confidence in his instructor that he will not lead him astray.

The student is particularly requested, that he rest not satisfied with only following me through my own diagrams and descriptions; it is requisite that he draw them out himself, to a much larger scale; nor be content with performing each case once only, but to practise them twice, or thrice, varying their positions, and attentively following the general rules given for their proper delineation; by which procedure his knowledge will not only be strengthened, but the practice will become easy and familiar. He should also observe to proceed step by step, as directed, nor draw one line but as told; then will all confusion vanish, misunderstanding be avoided, and the whole be clear and satisfactory.

Disgust is but too often conceived at the multiplicity of lines exhibited in works on perspective delineations, reflection not being made, that every line of the whole example, and every needful process requisite for the completion of that example, are there obligated to remain, that the same may be seen and done by the student; but in his performance much the greater part need only be drawn in pencil, and obliterated when the end required is obtained; and this of every process from first to last; thereby avoiding all necessity of confusion of operative lines, they being removed like as the scaffolding is taken from about a building as it is completed.

As my entrance on this subject is different from any that has hitherto been made public, I deem it somewhat incumbent on me to give my reason for deviating from the beaten track; and it is briefly, that I think, before a student is capable of executing the minutiae of this art, he should first comprehend and practise it upon a general and broad basis. I am therefore induced, in the first place, to give a number of examples for the delineation of the various simple forms of buildings, from the proper requisites given or known. In the second I shall exemplify the different parts of buildings, as doors, windows, steps, pedestals,

bases, and capitals of columns, cornices, vases, &c. And in the third, I shall combine the two former parts together, in the representation of regular, and some difficult, pieces of Architecture; and conclude with the leading principles for casting of shadows from a given place of the light. I purpose also, in an Addendum, to touch upon the subject of reflections on water, and plane mirrors, showing their positive and only true attainment by the rules of perspective; and a critical inquiry into some circumstances of dispute relative to distorted representations of objects, arising from injudicious proceeding, but from no error or fallacy in the rules of perspective delineation.

Before the practice is begun, I think it expedient once more to draw the attention to the principal definitions of terms used in the process of perspective delineations; and that they may be the more certainly understood, and more deeply impressed on the mind, I shall make reference from them to a scheme, which will, I am of opinion, with a little reflection, clearly show their relation and unity, beyond almost a possibility of misunderstanding.

DEFINITIONS*.

[Plate 12.]

1. ORIGINAL OBJECT, or OBJECTS. Is any object, or number of objects, proposed to be delineated; as a house, a ship, a man, or all, or many of them, together.

In Figure 1, Plate 12, the house ABCDFHK, is the *original object*.

2. ORIGINAL LINES. Are any lines that are the boundaries of original objects, or of planes in those objects.

The lines AB, BC, CD, &c. are *original lines*, being the boundaries of the *original object* ABCDFHK.

3. GROUND PLANE. Is the plane upon which the objects to be drawn are placed; and is always considered a boundless level plane.

The plane X, is the *ground plane*, whereon stands the object ABCDFHK.

4. POINT of VIEW, or POINT of SIGHT. Is the fixed place of the eye of the observer, viewing the object or objects to be delineated.

E, The eye of the observer, is the *point of view, or point of sight*.

5. STATION POINT. Is a point on the *ground plane*, perpendicularly under the *point of sight*, or eye of the observer, and expresses the station whence the view is taken.

S, is the *station point*, being a point on the *ground plane* perpendicularly under the eye of the observer, at E.

* These definitions refer also to my Apparatus.

[Plate 12.] 6. PLANE of DELINEATION, or The PICTURE. Is the canvass or paper, upon which it is intended to draw any object or number of objects.

The plane GIKL, is the *plane of delineation*; but in the extensive sense of the word, the *plane of delineation* is considered a boundless plane, however circumscribed may be the draft thereon made.

7. HORIZONTAL LINE, or the HORIZON. In perspective delineations, is a line on the *plane of delineation*, in every part level with the eye of the observer, or *point of view*.

VZ, Figure 1, is the *horizontal line*, on the *plane of delineation* GIKL.

The horizontal line is supposed obtained by the intersection of a plane passing through the eye of the observer, parallel to the *ground plane*, produced till it touches the *plane of delineation*.

The mere inspection of the diagram, Figure 2, cannot fail of giving thorough insight as to what is meant by the horizontal line, and how it is supposed obtained. FGHI is the *plane of delineation*, ABCD the *horizontal plane* passing through the eye of the observer touching the *plane of delineation* in the line BC, which is the *horizon*, or *horizontal line*.

8. CENTRE OF THE PICTURE. Is the point on the picture, perpendicularly opposite the eye of the observer or point of view; and is consequently always somewhere in the *horizontal line*.

⊙, in the *horizontal line*, Figure 1, is the *Centre of the Picture*, being perpendicularly opposite the eye, at E.

9. VERTICAL LINE. Is a line drawn through the *Centre of the Picture* perpendicular to the *horizon*.

PR, Figure 1, is the *vertical line*, being drawn perpendicularly through the *Centre of the Picture*, ⊙.

Note, the vertical line determines how much of the view lies to the right, and how much to the left, of the eye of the observer.

10. DISTANCE OF THE PICTURE. Is the direct line between the eye of the observer, and the *centre of the picture*.

E ⊙, Figure 1, is the *distance of the picture*, or *plane of delineation* GIKL.

11. GROUND LINE. Is the line made by the *plane of delineation*, touching the *ground plane*.

GL, Figure 1, is the *ground line* of the *plane of delineation* GIKL.

12. INTERSECTING POINT. Is a point made on the *plane of delineation*, by the producing of any line in an *original object*, till it touches the *plane of delineation*.

The point T, Figure 1, is the *intersecting point* of the original line BA. [Plate 12.]

13. INTERSECTING LINE. Is a line made on *the plane of delineation*, by the producing of any plane in an *original object*, till it touches the *plane of delineation*, or where, if produced, it would touch it.

The line WT, Figure 1, is the *intersecting line* of the original plane ABCDN; being the line, where that plane, if produced, would touch the *plane of delineation*.

14. VANISHING POINT. Is that point, on the plane of delineation, to which two or more lines will converge, which are the perspective representations of two or more parallel lines in an original object, placed inclined to the plane of delineation.

The point V, Figure 1, is the *vanishing point* of the line AB, being effected by the line EV being drawn from the eye of *the observer* parallel to it, and produced till it touches the *plane of delineation*, in the point V.

For the same reason, V is the vanishing point of the line CN; it is also the vanishing point for any other line that is parallel to the line CN, as BA; all parallel lines having the same *vanishing point*. The point Z, Figure 1, is the *vanishing point* of the line AK, being obtained by a line drawn from the eye parallel to the line AK, and produced till it touches the *plane of delineation*. The point Z is also the vanishing point of the original lines DF, and NH.

Note, There will be as many different vanishing points of lines in the delineation of an original object as there are different directions of lines in that original object.

The point I, Figure 1, is the vanishing point of the parallel original lines DN and FH; being effected by the line EI being drawn from the eye parallel to them till it touches the plane of delineation. And for the same reason Q is the vanishing point of the line CD.

In the process of perspective delineations, the plan of the object being drawn out, the place of the various vanishing points of horizontal lines is found on the ground line, whence they are transferred to the horizon by perpendicular lines over them; as may be seen, Figure 3. Where suppose S the station of an observer, and E the point of view; the lines SA and SB may be the direction of lines finding the vanishing points of any original lines, and being transferred perpendicularly to the points C and D in the horizon, answer the same as if they had immediately been obtained from the eye by means of the lines EC and ED. The effects of the same process may be observed in Figure 2, where the points F and I are transferred to the horizon perpendicularly, in the points B and C; the same as if they were effected on the horizontal plane by the lines EB and EC.

15. VANISHING LINE. Is a line on *the picture*, supposed made by a plane passing through the eye of *the observer* parallel to any *original plane*, and produced till it touches *the picture*.

The line VZ, Figure 1, is the *vanishing line* of an horizontal plane, and of all horizontal planes; being effected, by being the intersection of a plane passing

[Plate 12.] horizontally through the eye, or parallel to an horizontal plane. The vertical line IVG, is the *vanishing line* of the original vertical plane ABCDN, being the line where a plane passing the eye of the observer parallel to that plane, would touch the *plane of delineation*.

There will be as many different *vanishing lines* on the *plane of delineation* as there are different positions of planes in the object or objects; and all parallel planes will have the same *vanishing line*. Also all lines lying in the same plane will have their *vanishing points* in the *vanishing line* of that plane.

All planes or lines in an *original object*, which are situated parallel to the *plane of delineation*, can have no *vanishing lines* or *vanishing points* on the *plane of delineation*.

16. VISUAL RAY. Is an imaginary right line, implying a ray of vision directed from the eye, to any point, the object of its regard or contemplation.

EA, or EI, &c. Fig. 1, are *visual rays*, being right lines from the eye to the points A and I.

A number of visual rays directed to every part of an object, must form a pyramid of rays, of which the eye is the apex, and the object the base.

17. A PERSPECTIVE DELINEATION. Is such a delineation as may be supposed to be made by a plane making a section of a body or pyramid of rays proceeding from an eye, while contemplating an object, or many objects. Such a figure, or such figures, obtained by the rules of perspective, is called a perspective delineation.

The section of a pyramid of rays, producing a perspective projection, is most commonly considered as being taken between the object and the eye; but the section of rays may be taken when they are extended beyond the object, in which case such a section is called a projected perspective representation of the object. The latter case gives such a figure of the contour of the object, as would be made by the shadow of it from a torch being put in the place of the eye of the observer; as may be distinctly seen, Figure 4. Where G may be considered the place of the eye, or torch; HI the object; abcd, the intervening plane; and KLMN the exterior plane beyond the object. The section of the rays hi, on the plane abcd, is called the perspective or scenographic projection; and the section mn, on the plane KLMN, the projected perspective representation, or shadow by torch light.



To know perspective, is to know the rules so to delineate objects, as to express their apparent lessening, as they are more and more remote. The apparent lessening of objects, and their change of form, is the silent language of nature indicative of distance and variety of position. Perspective, according to the elegant and correct definition of Addison, is, “the science by which things are ranged in picture, according to their appearance in their real situation.”

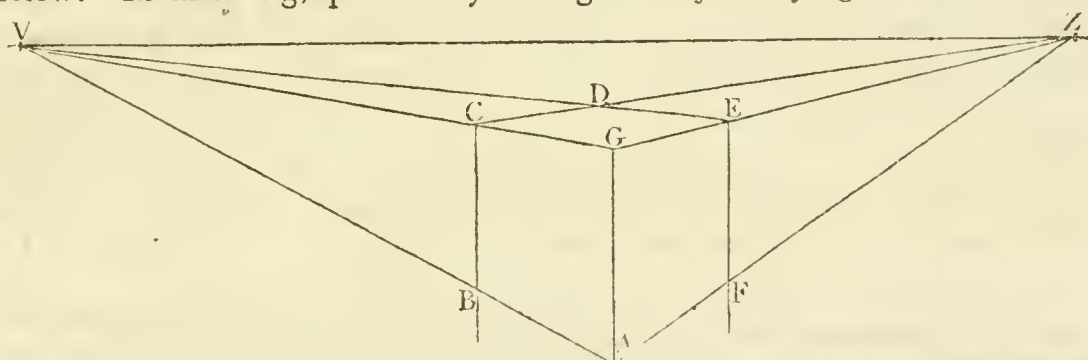
The situation of the objects being given, with the place and position of the plane of delineation, and height and distance of the eye of the observer; the delineation of the objects is truly determinable by rule, and may most mechanically be performed, as follows :

EXAMPLE I.

[Plate 13.]

Let it be required to find the apparent form that a cube would exhibit, if when placed over the square ABCD (Fig. 1, Plate 13), its base, it was viewed by an eye elevated two inches perpendicularly over the station S, and supposing the plane of delineation to stand vertically over the line GL.

First, I would advise the Student to place a cube before him in the position stated, and recommend that a sketch of its appearance be made by the eye alone, as correctly as he can, which will for certain be a form agreeable to the figure below. In sketching, particularly of regular objects, judgment should ever



direct the hand ; as here, the eye being elevated somewhat above the cube, the top of it will, of consequence, be seen, and, in the position stated, will appear nearly of the form of the delineation G C D E, and whatever may be the height of the near angle of the cube in the drawing, as A G, the more remote angle, C B, being to represent an equal height seen at a greater distance, should be made somewhat less than A B. In which case the horizontal lines of the top and bottom, G C and A B, will be inclined to each other, and would, if produced, meet ; and being horizontal lines, or the representations of horizontal lines, would meet somewhere in the horizontal line. Suppose the line V Z the place of the horizon, V would be the point of their union or tendency,

called their *vanishing point*. For the same reason the angular line EF' , should also be made less than the angle AB ; and the point of tendency of the horizontal lines GE and AF , would also be in the horizon, at the point Z . The figure required, therefore, will nearly resemble the figure here drawn, the figure $ABCDEF^a$.

[Plate 13.] Clearly to understand what we are about to do, is the first and surest step to compass the end desired. We are now going to obtain, by mechanical process, the figure that the contour of a cube would make standing over the square $ABCD$, to the eye of an observer raised two inches above the point S ; the point S , and the base of the cube, standing on the same level plane.

Knowing the figure of its appearance from the sketch, we will now obtain its *precise* form, according to principle, with ruler and compasses^b. Draw the necessary operative lines (Fig. 14, Plate 10); Through the station S , Fig. 1; draw the line XY , parallel to the direction of the plane of delineation, GL ; then the lines SG and SL , respectively parallel to the lines AB and AD of the base of the object, which lines, produced to the plane of delineation, determine the *vanishing points* of the horizontal lines AB and AD , and of all horizontal lines parallel to them. Draw the line $S\odot$, perpendicular to GL ; which line being the perpendicular direction of the eye to the plane of delineation, determines the point on the picture to which the eye should be directly opposite to view it when done; and shows how much of the object is on the one side, and how much on the other, of the point of view. Lastly, draw the visual rays SB , SC , and SD , cutting the plane of delineation in the points b , c , and d .

Thus much is necessary for the preparation of the plan; the picture^c, or plane of delineation, is prepared, as follows. (See Figure 2.) First, draw the

^a I would recommend the Student to have three or four cubes, of about three inches square, and advise that he apply them before him agreeably to the cases as they occur, and first sketch their appearance by the eye and hand alone, and after, perform the same by rule.

^b The Student should here put paper on his drawing-board, and set the very examples himself as they occur, and to a larger scale. In the present instance, he should place the square of the base of the object $ABCD$; then draw the line of the plane of delineation GL , fix his station, S , and proceed with his drawing exactly as directed in the process. Among many good advantages that will attend the so doing, will be one, not the least, that of his not having a confusion of lines at one time; for, drawing them only as directed, every thing will be clear and devoid of confusion. It is otherwise with all the diagrams in the work; the present, for instance, includes four distinct Examples that will be separately treated on, and has all the necessary lines drawn that relate to them, exhibited at once to view.

^c The picture should be made on a paper separate from the plan, though here they are done all on one, to show their connexion the more clearly, and for want of room.

ground line GL , and, parallel to it, and two inches above it^a, as stated, the [Plate 13.] horizontal line, VZ . Mark on the horizon the point \odot , to which the eye is supposed to be perpendicularly opposite, to view the picture when done. Every other preparation is taken from the plan, and may be done in the order following. Set off the distances of the vanishing points $\odot G$ and $\odot L$, Figure 1, on the horizon, Figure 2, at $\odot V$ and $\odot Z$; also the several distances $\odot b$, $\odot c$, $\odot A$ and $\odot d$, Figure 1, at $\odot b$, $\odot c$, $\odot A$, and $\odot d$, on the ground line of the picture, Figure 2, through which points draw fine perpendicular lines, indefinite, which lines I will call visual lines, and thus proceed.

As the near angle of the object, A , touches the plane of delineation, it is clear that that angular line, in the representation, will be the same height as the object; that is, equal to the length AB or AD in the plan, Figure 1. Take therefore the length from A to B in the compasses, and apply it on the perpendicular line AB , Figure 2, and draw the lines BV and BZ ; also AV and AZ , which cutting the other visual lines in the points e , f , and h , i , determines the two perpendicular sides of the cube $AefB$ and $ABhi$. Then draw the lines hV and fZ , intersecting each other in the point g , in the perpendicular line gc ; which will complete the whole linear representation of the cube $Aefghi$. If the delineation $Aefghi$ were placed upright over the line GL (Figure 1), the line GL of the one, placed exactly on the line GL of the other, and the points b , c , A and d of the one, over the points b , c , A and d of the other, a solid cube put on the square $ABCD$ would exactly fit the figure $Aefghi$, were it cut out, and viewed by an eye elevated two inches over the station point S^b .

EXAMPLE II.

[Plate 13.]

Let it be required to find the form that another cube would exhibit, when placed by the side of the first, and viewed from the same station and point of view.

The square $BEFC$, Fig. 1, is the base of the second cube, and being posited in the same direction, and parallel to the first, the same preparatory lines will serve; there only remains to draw the visual rays ES and FS cutting the ground line GL in the points x and w .

^a In this diagram it is two inches, but in that made by the Student it may be to three or four times the scale, that is, six or eight inches, or any height at pleasure.

^b The Student, provided with cubes, is advised to try this little experiment, when he has completed his drawing, and he will find it perfectly satisfactory.

[Plate 13.] The same preparatory lines on the picture (Figure 2) will also serve in this case. VZ will be the horizon, and Y , and Z , will be the vanishing points of the horizontal lines. Take the distances $\odot w$ and $\odot x$, Figure 1, in the compasses, and apply them at $\odot w$ and $\odot x$, Figure 2, and draw the perpendicular visual lines pw and nx , indefinitely.

The two cubes being in contact with each other, the angle over B is common to them both; and because in the same direction, the lines BV and AV , Figure 2, being drawn, determine the side $ekmf$; which side being obtained, draw then the lines mZ and gV , intersecting at n , and the figure of the second cube is determined, and is the figure $ekmng o$. The side $efgo$, being in contact with the first cube, cannot be seen unless the bodies were transparent.

EXAMPLE III.

It is required to find the figure that a cube would exhibit, if, placed over the square BEFC, Figure 1, it was viewed by an eye two inches above the station S, the plane of the picture standing perpendicularly over the line GL.

Note, The Student is desired to pay particular attention to this proposition, and view it as a new example under the stated premises.

Draw the lines SG and SL parallel to the sides of the object BE and BC , in order to obtain their vanishing points, G and L . Draw the visual rays ES , BS , FS , and CS , cutting the ground line GL in the points x , b , w , and c ; and produce the line of the object, EB , till it intersects the ground line in the point A . Lastly, draw the line $S\odot$ perpendicular to the line GL .

Prepare the picture, Figure 2, by drawing the ground line GL , and parallel to it, and two inches above it, the horizontal line VZ . Fix the point \odot in the horizon, the point opposite the point of sight^a; and also the point \odot in the ground line, directly under it. Set off the distances of the vanishing points G and L , Figure 1, at V and Z , Figure 2; also the several distances $\odot x$, $\odot b$, $\odot w$, and $\odot c$, Figure 1, at $\odot x$, $\odot b$, $\odot w$, and $\odot c$, Figure 2, and draw fine perpendicular lines, in pencil, through them.

Because the near angle of the object is at a distance from the picture, it will not be represented on the picture, its full height; that is, equal to the real height of the object; that is done only when the object touches the plane of delineation;

^a That point, on the picture, is often called the CENTRE OF THE PICTURE, meaning thereby that the point of sight should be directly opposite it, at its proper distance; and for the future, for the sake of brevity, it shall be so called, throughout the work. See Definition 8.

as it did in the first example at the angle A. Its reduced height therefore, [Plate 13.] agreeable to its distance from the picture, must be obtained; and which is very readily done as follows:

If the plane of the object, in the direction of the line EB, Figure 1, were continued forward, it would touch the plane of the picture in a perpendicular line over the point A, and would there mark its height. Let that be done, by producing the line EB to A; then set off the distance $\odot A$, Fig. 1, at $\odot A$, Fig. 2, and draw the line AB, Fig. 2, indefinite. The line AB is the intersecting line of the plane of the object in the direction of the line BE, Fig. 1 (Def. 13).

Proceed on the picture in the following manner; on the intersecting line AB, make AB equal the height of the object, and draw the lines BV, and AV, which, crossing the visual lines bf and xm, determine the plane ekmf, for the representation of the plane of the object over the line EB, Fig. 1, from which part the whole figure is soon obtained. By drawing the lines fZ and eZ, the plane efgo is determined, and drawing the lines mZ and gV, the top of the cube, fmng, is found, and the whole figure, ekmn go, is completed, which is in the linear representation of the object. Reflection will immediately point out, that the figure but just now obtained, must be the same with the one found by the second example, which was done by means of the angle ef, of the first cube; 'tis only supposing the first taken away, and the second left by itself.

When neither side of the object touches the plane of the picture, it is immaterial, as to the performing of the operation, which side is produced for an intersecting line; choice only should be made of that which will least interfere with the work. In the example, just performed, the side EB was produced for an intersection, as at A, but the side BC might as well have been produced^a; let it be so done, as at K, Fig. 1, and mark off the distance $\odot K$, at $\odot K$, Fig. 2, where make the height KM equal the height of the object, that is, equal to the height AB, and draw the lines MZ, and KZ, which will fall in with the before-found lines fg and eo, and form the plane efgo; from which the whole figure could readily be completed, as may be observed from inspection.

EXAMPLE IV.

It is required to give the representation of a cube as being placed directly upon the one found by the former example, that is, upon the cube standing on the square BEFC, under the premises stated, with the last example.

The same preparatory lines in plan and picture, with the last, will serve in

^a The Student is desired to draw the whole figure by means of that intersection, that he may be convinced of the truth of either process, and of the coincidence of both.

[Plate 13.] this example. In Fig. 2, lengthen the visual lines $k m$, $e f$, and $o g$, to p , q , and r ; then proceed as follows:

Set up the height of the cube on the intersecting line $A B H$, Fig. 2, above the height of the first, that is, make $B H$ equal $B A$, and draw the lines $H V$, and $q Z$ cutting the visual lines in the points q , p , and r , giving the figure $f m p q r g$ for the contour of the required cube; which rising above the horizon, the top is not seen, and the horizontal lines $p q$, and $q r$, decline to their vanishing points V and Z .

The Student is advised to place three cubes, agreeably to the disposition of the three cubes forming the group, Figure 2; and, having so placed them, to draw their appearance by the hand and eye, as nearly as possible from the same point of view; afterwards to draw them as one example correctly by rule.

The linear representations only, of the cubes have been described, but the assistance of shade has been given, that their forms might be the better discerned; and the Student is advised to colour each of his operations, as they are performed. A double advantage will thereby be obtained, that of embodying his linear figures, and gaining a freedom of shadowing and tinting at the same time.

If it should be suggested, of what advantage can the drawing of cubes placed in such or such positions be? I can only answer, that, from the simplicity of their forms, they are given as first examples; but though simple, they may nevertheless comprise the forms of irregular and picturesque figures, as well as regular and formal ones, of which Figure 3 may serve as an instance, and is given to intimate that a subject of difficulty may be derived from a subject of much apparent simplicity.

There can be but two ways of placing a cube, in a vertical position, to the plane of delineation, and those are, either with both sides inclined to it, as has already been four times done, or with one side parallel to it, and the other, of consequence, perpendicular to it. Inclined positions have been given; we will now proceed to delineate a parallel one.

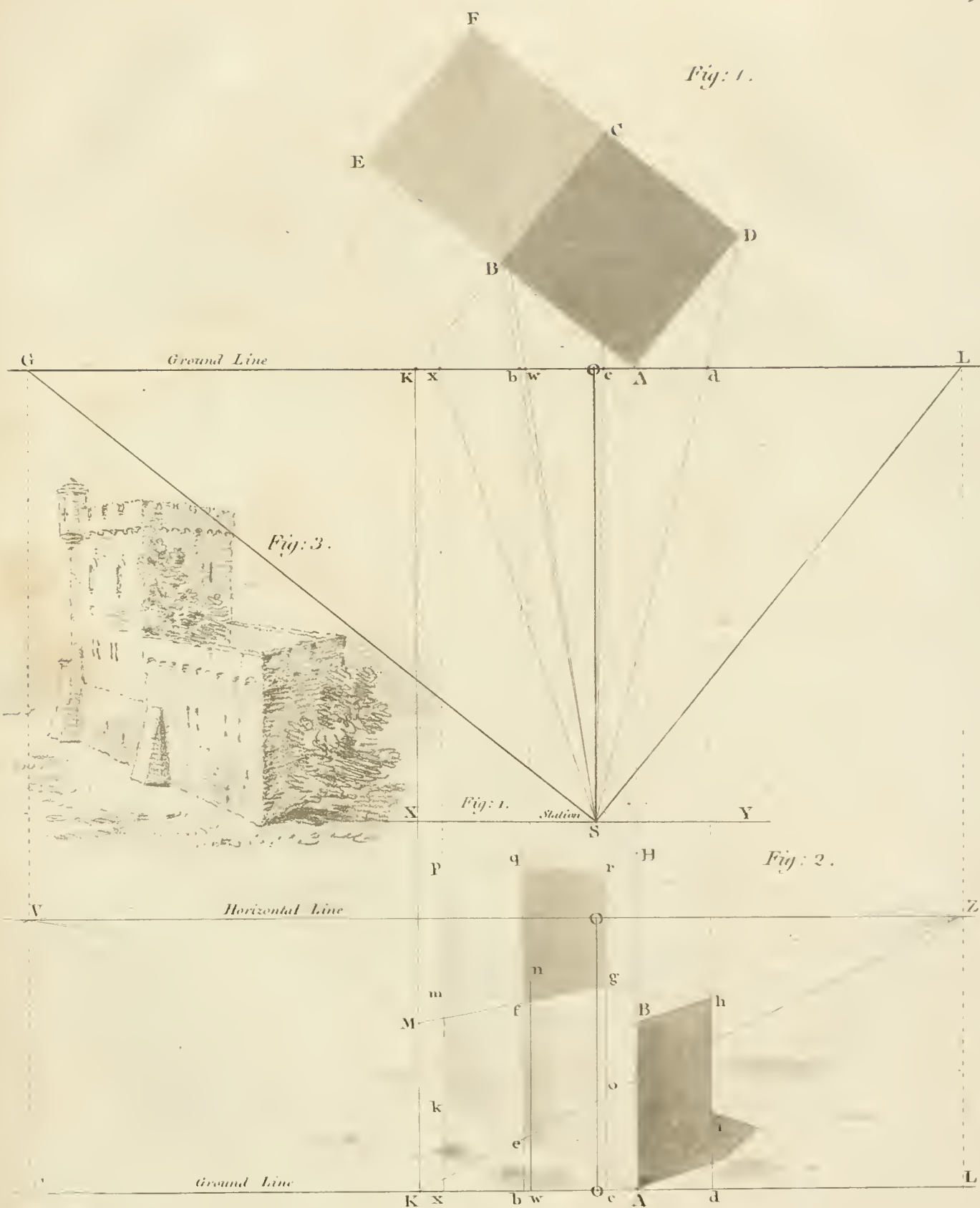
[Plate 14.]

EXAMPLE V.

It is required to find the appearance that a cube would make, on the plane of delineation, when placed with one side parallel to that plane.

Let the square $A B C D$, Figure 1, Plate 14, be the situation of the cube; the line $G L$, the position of the plane of delineation, parallel to the face of the cube over the line $A B$; and let S be the station of the observer.

If the face BA of the cube, touched the plane of delineation, it is clear, a square, equal to the square $A B C D$, Figure 1, would be the representation of



that square; but it is at a little distance from it; consequently, though it will be a square, as being a parallel section of the pyramid of vision, it will be a somewhat smaller square than the face of the cube, and smaller in just proportion to its distance from the picture. To ascertain which, it is necessary to have an intersection of some plane of the object with the picture, as of AD in the point I . Draw the line $S \odot$ perpendicular to the ground line GL , \odot will be the vanishing point of the line AD and of all lines parallel to it; also draw the visual rays AS , BS , CS , and DS , cutting the ground line, in the points b , c , a , and d . [Plate 14.]

Prepare the picture (Figure 2), as follows: Draw the ground line GL , and parallel to it, and at any height at pleasure, the line YZ , for the horizontal line. Mark the point \odot , the centre of the picture, on the horizon, and also the point \odot perpendicularly under it, on the ground line. Set off the several distances of the visual intersections, $\odot b$, $\odot c$, $\odot I$, $\odot a$, and $\odot d$, Fig. 1, at $\odot b$, $\odot c$, $\odot I$, $\odot a$, and $\odot d$, Fig. 2, and draw fine pencil lines perpendicularly through them, upwards on the picture.

The line drawn through the point I , is the intersecting line, on which mark the height of the cube, as IK , equal to a side of the cube in the plan, as AB , Fig. 1, and draw the lines $K \odot$ and $I \odot$, Fig. 2, cutting the visual lines an , and di , in the points n , i , and e , k , forming the plane $enik$, as the representative face of the cube, over the line AD in the Plan. Parallel to the horizon draw the lines ng and ef , determining the square $efgn$, as the representative square over the line BA in the plan, Fig. 1. Lastly, draw the lines $g \odot$ and ih , intersecting in the point h , forming the figure $ng hi$, as the top of the cube, and giving the figure $efghik$, as the linear representation of the whole cube, under the premises stated.

EXAMPLE VI.

Figure 3 represents the plan of three rectangular solids, placed side by side, forming the general figure $EFHK$.

It is required to find their representation, supposing them to stand with both faces inclined to the plane of delineation, which is given in the place and direction of the line GL , and S is the station of the observer.

Draw the preparatory lines; first the line WX , parallel to the ground line GL , then the line $S \odot$ perpendicular to it; also the visual rays FS , PS , NS , ES , MS , and KS , cutting the ground line in the points e , f , g , h , i and k ; and produce the face of the object FE , to B , for an intersection. Lastly, draw the

[Plate 14.] lines SV , and SR , respectively parallel to the two faces of the object EF and EK , to obtain their vanishing points.

It will be observed, that there is not extent enough of paper for the line of the picture, GL , and the line SR , to come in contact; in such case an expedient must be used. Take any portion of the distance of the picture $S\odot$, suppose half, as at m , and draw the line mL parallel to SR ; then will the distance $\odot L$ be half the distance of the required vanishing point. Should the line at half the distance not come within the limits of the paper, then let a third or a fourth of the distance be taken; the parallel line being drawn, will give a proportional distance of the vanishing point.

Let the line BC , Fig. 4, be the direction of the plane of the picture, let A be the station point, AC will be the distance of the picture. Let AB be the direction of a line finding a vanishing point at B . Divide the distance of the picture into two equal parts at D , and draw the line DE parallel to AB ; then will the distance CE be *half* the distance CB . Take a third part of the distance AC , at F , and draw FG parallel to AB ; then will GC be a *third* part of the distance BC . Thus whatever portion is taken of the one, drawing the parallel line will give a like portion of the other, for the triangles formed are similar, and the corresponding sides will therefore be proportional.

Prepare the picture^a Fig. 5; that is, draw the horizontal line YZ , and the ground line GL , parallel to each other, at any distance at pleasure. Fix on the point \odot , in the horizon, for the centre of the picture, and draw the vertical line $\odot\odot$. Set off the distance of the intersecting point B , Fig. 3, and of the visual points $\odot e$, $\odot f$, $\odot g$, $\odot h$, $\odot i$, and $\odot k$, at A , and $\odot e$, $\odot f$, $\odot g$, $\odot h$, $\odot i$ and $\odot k$, Fig. 5, and draw the visual lines through them. Lastly, set off the distance of the vanishing point V , Fig. 3, at P , Fig. 5, and the distance of the vanishing point Z , Fig. 5, at twice the distance $\odot L$, Fig. 3^b; and proceed in the following manner:

On the intersecting line AC^c , Fig. 5, set up the height of the object, which suppose AB , and draw the lines AP and BP , cutting the perpendicular visual

^a Preparation of the picture, always implies, first, determining the distance of the horizontal and ground lines (Def. 7 and 11). Secondly, the fixing on the centre of the picture (Def. 8), and drawing the vertical line (Def. 9). Thirdly, the setting off the distances of the vanishing points (Def. 14), and setting off the distances of the intersections of the visual rays, with the ground line, in the plan, on the ground line of the picture; and this is desired to be understood and done in future, on the being told to prepare the picture.

^b It is absolutely necessary, without having recourse to a very troublesome process, which shall be given in the course of the work, to have the places of the vanishing points, on the picture, that the relative lines may be drawn in true direction to them. When the paper, or drawing-board, is not long enough to receive them on it, a piece must be added, as here, or a lath must be fixed to the board; where, placing a pin in the vanishing points, a ruler may be laid to them, and the work may be done with as much accuracy, as were they not above a foot distance.

^c The Student will observe, that when by reference one course of the alphabet has been exhausted, I have been of necessity reduced to begin another; by which the same letter will be sometimes twice or thrice repeated in the same plate; but by being used in parts remote from each other, it is hoped all confusion will be avoided. I think such proceeding better, than having recourse to Italic, or Greek letters, as some authors have done; by which, the Student, not acquainted with Greek characters, is quite at a loss what to call them.

lines, and determining the figure $abcd$, for the representation of the face of the object over the line EF , Fig. 3; then draw the lines dZ and aZ , which will obtain the plane of the end of the object $adno$; and lastly draw the lines cZ and nP , intersecting at m , and completing the figure $abcmno$; the figure required. By drawing the lines xZ and vZ , the whole figure is divided into three parts, agreeable to the three rectangles in the plan, Fig. 3. [Plate 14.]

EXAMPLE VII.

It is required to find an equal and like figure to one of the foregoing, as if placed on the second of the three figures of the last example.

As this example introduces no new position of plane in the original object, the same preparatory lines will answer, as in the former example; and as all the visual lines are already drawn, it is necessary only to heighten them.

On the intersecting line AC , Fig. 5, set up the height BC equal BA , and draw the line CP ; determining the plane $vxpq$ for the front of the required representation; after, draw the lines pr and qs to their vanishing point, Z , giving the plane $vqst$, as the other side of the object; to which the top is added by drawing the line sP , shaping the figure $qp rs$, for the top; and completing the form $vxp r s t$, the representation required.

The top of the object $qp rs$, Fig. 5, being very near the horizon, is, of consequence, very little seen; had the object been higher, still less would have been visible; had it fallen in with the horizon, that is, had BT and not BC been the height of the object, none of the top could have been seen, but its representation would have been a line in the direction of the horizon.

Fig. 6 is meant to show what the compound of the two last simple examples might involve; and is introduced to encourage the Student in his pursuit, by giving a foretaste of the result of his labours, and to instance that while he is applying rules and principles upon, seemingly, very uninteresting objects, the same extend to and embrace irregular and picturesque ones.

Hitherto the examples have united as few different directions of planes, forming a solid figure, as could well be given; they may be supposed to have been buildings with flat or no roofs; it is now my intention to introduce other directions of planes, as inclined roofs; and these in some variety.

Roofs are of various kinds, but two only are necessary to be observed upon here, and these are what are called gable-end roofs, and hipped roofs. A gable-end roof, is when the end walls of the building go perpendicularly up to the point of the ridge, and the ridge extends from end to end of the building.

[Plate 15.] The upper part of the end walls are therefore of a triangular form, to the depth the roof slants down. ABCDE, Fig. 1, Plate 15, represents the end wall of a gable-end roof; CDE being the triangular part formed by the roof. A roof is said to be hipped when the ridge comes short of the extent of the building and slants down on every side; A EFGH, Fig. 2, may convey the idea of a hipped roof; and both one and the other be further explained by Fig. 3, where the line IK indicates the ridge of a gable-end roof, and OP the ridge of a hipped one; and OM and PN the slant at the ends. A roof may have one end gable and the other hipped, and is often so constructed.

EXAMPLE VIII.

It is required the representation of a quadrangular building situated with each side inclined to the picture, covered with an A^a roof, each end being a gable-end.

Let the rectangle ABCD, Fig. 4, be the plan of the building; the line EF will be the place of the ridge of the roof; extending from end to end. Let the line QL be the place of the plane of delineation, and let S be the station point.

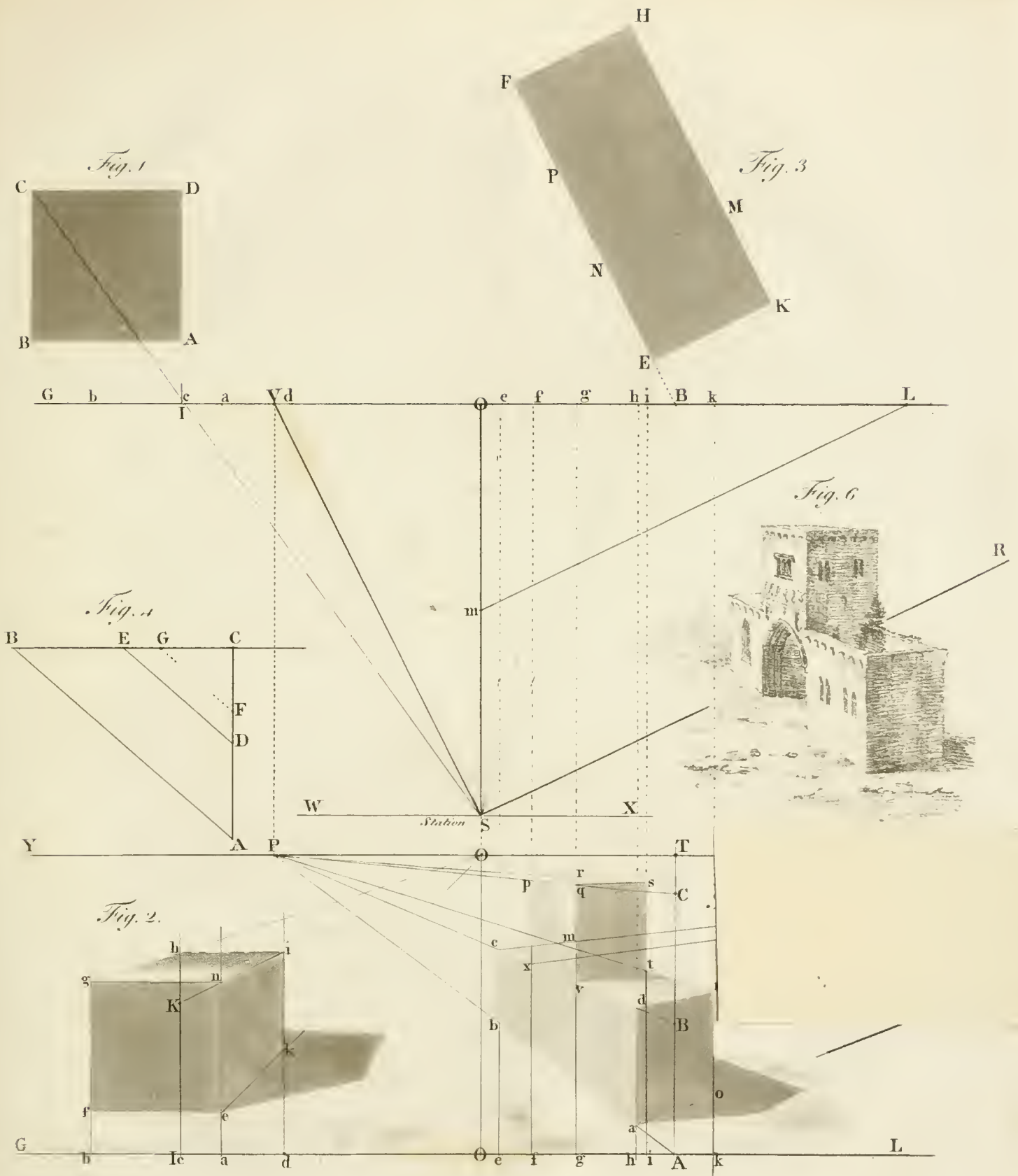
Find O, the centre of the picture; also the points Q and L, the vanishing points of the lines AB and AD and their parallels. Produce the face of the building AD to I for an intersection with the picture; and draw the visual rays intersecting the ground line of the picture in the points b, e, a, f, and d^b.

Prepare the picture, Fig. 5, by drawing the horizontal and ground lines VZ, and GR, at any distance from each other at pleasure; fix upon the centre of the picture O; and draw the vertical line OO; set off the distances of the vanishing points O V and O Z, equal the distances of the vanishing points O Q and O L in Fig. 4; draw the intersecting line IL, Fig. 5; and all the visual lines through the points b, e, a, f and d; taken from their respective places and distances b, e, a, f, and d, Fig. 4; and proceed as follows:

On the intersecting line IL, Fig. 5, set up the height IK, equal the height of the building BC or HG, Fig. 1 and 2; and draw the lines KZ and IZ, determining the plane g m o p, for the front of the building. Draw the lines

^a A single pitched roof is constructed in the form of the Roman capital letter A, and is therefore, by builders, called an A roof. A double pitched roof is, for the same reason, called an M roof, as it nearly resembles that letter; but is more like the letter W, inverted, thus Λ .

^b It is not necessary to draw the visual rays beyond their intersection with the ground line of the picture: it is sufficient they be drawn to there, in the direction to the station point; for the future, therefore, they will be drawn no farther, and the station being fixed, and expressed on any part of the plate, it will be sufficient the visual rays be drawn to the picture in direction to that point.



m V and g V, determining the end of the building g h i m. It now remains to [Plate 15.] place the roof, which is readily done, but which however requires some circumspection in the process.

Place the height of the roof X D, Fig. 1, on the intersecting line at I L, Fig. 5, and draw L Z, which will give the height of the roof on the angular line of the building g m, at r; from which spot it may readily be transferred to its proper place in the visual line e k, by the line r V, which cuts the line e k in the point k, the point required. From the point k draw the lines k i, and k m, completing the gable-end of the building. Draw the ridge of the roof k Z cutting the end visual line, in the point n; and lastly, draw the line n o, completing the whole linear delineation of the building g h i k n o p.

It must be carefully observed, that whatever original plane is produced to the picture to obtain an intersection, that that intersection serves only to obtain heights in the direction of that plane; whence they may be transferred to other planes in contact with it; as in the present instance. The intersecting line I L, Fig. 5, is the intersecting line of the plane g m o p; of consequence, any original height set up on that line can only be transferred throughout the direction of that plane; for instance, the height of the roof K L was transferred by the line L Z, all along that plane to its other extremity s, but the line r s is not the place of the ridge of the roof, which lies in the middle of the plane g h i k m, proceeding from the point k; but any height on the angular line g r, is easily transferred along that plane by means of its horizontal vanishing point V: by which means the height of the roof was obtained by the line r V, at k. If, instead of the plane over the line A D, Fig. 4, being produced for an intersection, the plane of the middle of the house in the direction of the ridge of the roof, had been drawn, and the height of the roof had been set up on that line, it would, at one application, be transferred to its proper place.

Let the line F E, Fig. 4, be produced to P for an intersection; set off the distance $\odot P$, at $\odot P$, Fig. 5, and draw the intersecting line P R. On P R, set up the height of the ridge of the roof, equal the height X D, Fig. 1, and draw the ridge line R Z, which line will determine the exact ridge of the roof between the proper visual lines, and will be found to correspond, exactly, with the ridge before obtained, by the former process.

The roof may be found by a very different process*. I do not show it for its beauty alone, though that is great, or for its utility either, but to manifest the truth of the rules of Perspective, by experience of their just coincidence.

The flant lines of the roof will have their vanishing points on the picture, as well as any other direction of lines in the same object. The line k m, Fig. 5, being in the vertical plane g h i k m, will have its vanishing point somewhere in the vanishing line of that plane (Def. 15). A vertical line drawn through the horizontal vanishing point V, will be the vanishing line of the plane g h i k m;

* If the Student possess not a considerable degree of discernment, and quick penetration, it will require some serious investigation ere this process be fully comprehended, which, in truth, it is almost impossible to make perfectly clear without proper apparatus, and personal explanation.

[Plate 15.] of consequence, the vanishing points of the lines km , ki , and all lines parallel to them, will be somewhere in the vertical line $GVQX$.

Two lines drawn from the eye, parallel to any two lines in an object, finding their vanishing points, will make the same angle at the eye, as the lines in the object make with each other; for the two lines in the one instance are respectively parallel to the two lines in the other.

The line SQ , is drawn from the station S , parallel to the line AB , Fig. 4, and a line drawn from the station S , making the same angle with SQ , as ED does with EC , Fig. 1, will find the vanishing point of the line ED , and which point must evidently be somewhere in a vertical line through the point Q . To obtain which point in practice, take the distance of the vanishing line it is in, that is, the length from S to Q , in the compasses, and set off the same on the horizon, Fig. 5, from V to W . At the point W make an angle, VWX , equal to the inclination of the roof, that is, equal to the angle CED , Fig. 1, and produce the line till it intersects the vertical line through the vanishing point V , in the horizon, in the point X . The point X will be the vanishing point of the line of the roof km , Fig. 5; and of the line no , parallel to it. The slant lines of the roof km and no , already obtained, will, on application of a ruler, be found to tend to the point X , agreeably to the above statement.

By the same reasoning the line of the roof ki , Fig. 5, will also have its vanishing point, and in the same vertical line GVQ . It will be found to be as much below the horizontal vanishing point V , as the point X is above it. See the plate explaining the definitions, under the article Vanishing Point; Def. 14.

Let the line AB , Fig. 6, be the line of the horizon; let the line CD be the vanishing line of a vertical plane, being the gable-end of a house; and let the angle ABC be the angle of inclination, finding the vanishing point of the slant lines of a roof in one direction. Let the line BD be the line, finding the vanishing point of the slant lines in the other direction, having the same inclination to an horizontal line: then will the angle ABD be equal the angle ABC , and the distance AD equal the distance AC .

EXAMPLE IX.

It is required to find the representation of a quadrangular building, situated inclined to the picture, covered with a single hipped roof.

Let the quadrangle $GDHK$, Fig. 7, be the plan of the building, the line MN will represent the ridge of the roof. The former line QL may be the

place of the plane of delineation, and it may be viewed from the same station S. [Plate 15.]

The position and direction of the lines of this object being the same as those of the former example, the preparatory lines that served the preceding, will answer for this. It is requisite only to draw the visual rays MS, NS, GS, PS, and KS, intersecting the picture in the points m, n, g, p, and k; and to produce the line DG, for an intersecting point, at R.

Prepare the picture, Fig. 8. Let the line VZ be the horizon; GR the ground line; O the centre of the picture; and the points m, n, g, p, and k, the corresponding points with m, n, g, p, and k, Fig. 7. Draw the visual lines through those points, and the intersecting point R, and proceed as follows:

On the intersecting line RE set up the height RT, equal the height of the object HG, Fig. 2, and draw the lines TV and RV, cutting the visual lines of the front of the building in the points z and o, y and p, determining the plane ypoz, for the representation of the plane of the front: from the angular points z and y, draw the lines zw and yx, to their vanishing point Z, determining the plane yzwx for the end of the building.

On the intersecting line, set up the height of the roof TE, equal the height NK, Fig. 3, and draw EV cutting the angular visual line of the building in the point e; from which point draw the line eZ, cutting the visual line pa, in the point a, the point of direction of the ridge of the roof; draw the line aV, which, cutting the visual lines through the points m and n, in the points t and v, determines the exact portion of the ridge of the roof, tv, which is the representation of OP, Fig. 3, or of the ridge MN, Fig. 7: draw the lines to, vz, and vw, which will complete the whole representation required^a.

In Fig. 8. If the lines az and aw be drawn, they will form a gable-end yzawx, of which the point a is the point of the gable, and will answer for the direction of the ridge, whether it be a gable-end, or a hipped roof; for in both cases it lies in the middle of the breadth of the house; wherefore the line aV answers as well the ridge of a hipped roof, as of a gable-end.

On examination of the plans of the two buildings, Figures 4 and 7, it will be observed, that they are placed at right angles with each other, and in contact at the point D; which being the case, the second example could have been easily accomplished from the first, without need of another intersection, or other preparatory lines, than merely the additional visual rays from the visible

^a The Student is particularly advised to be sure he perfectly understands the process of these two examples ere he proceeds farther; as all that will follow, will, more or less, have relation to them. He is recommended to practise them on a large scale, that he may the better see the affinity and relation the lines and planes have to one another; and to be very careful in the process.

angles of the structure; but the exemplification of this process shall be made part of the subject of the next example.

[Plate 16.]

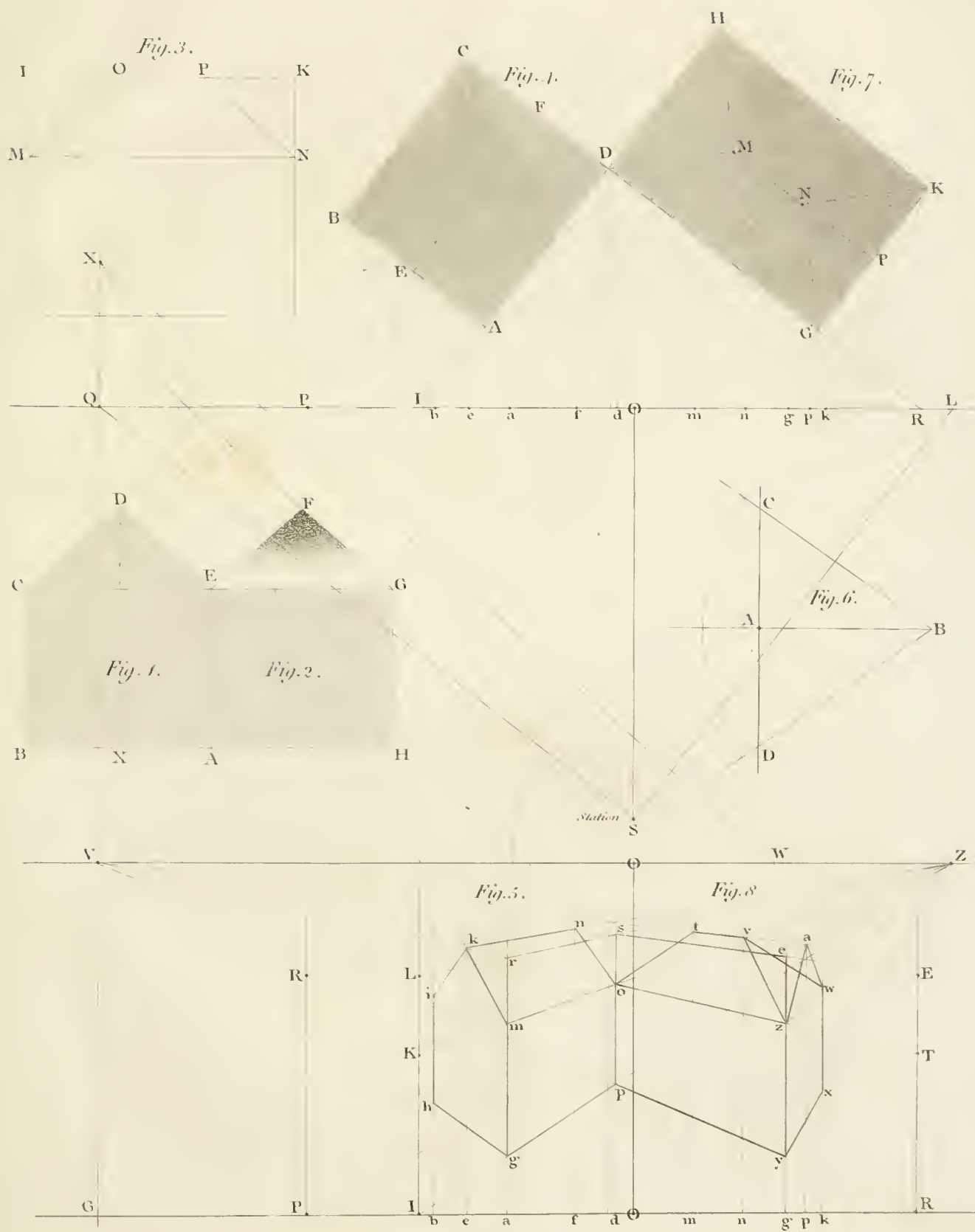
EXAMPLE X.

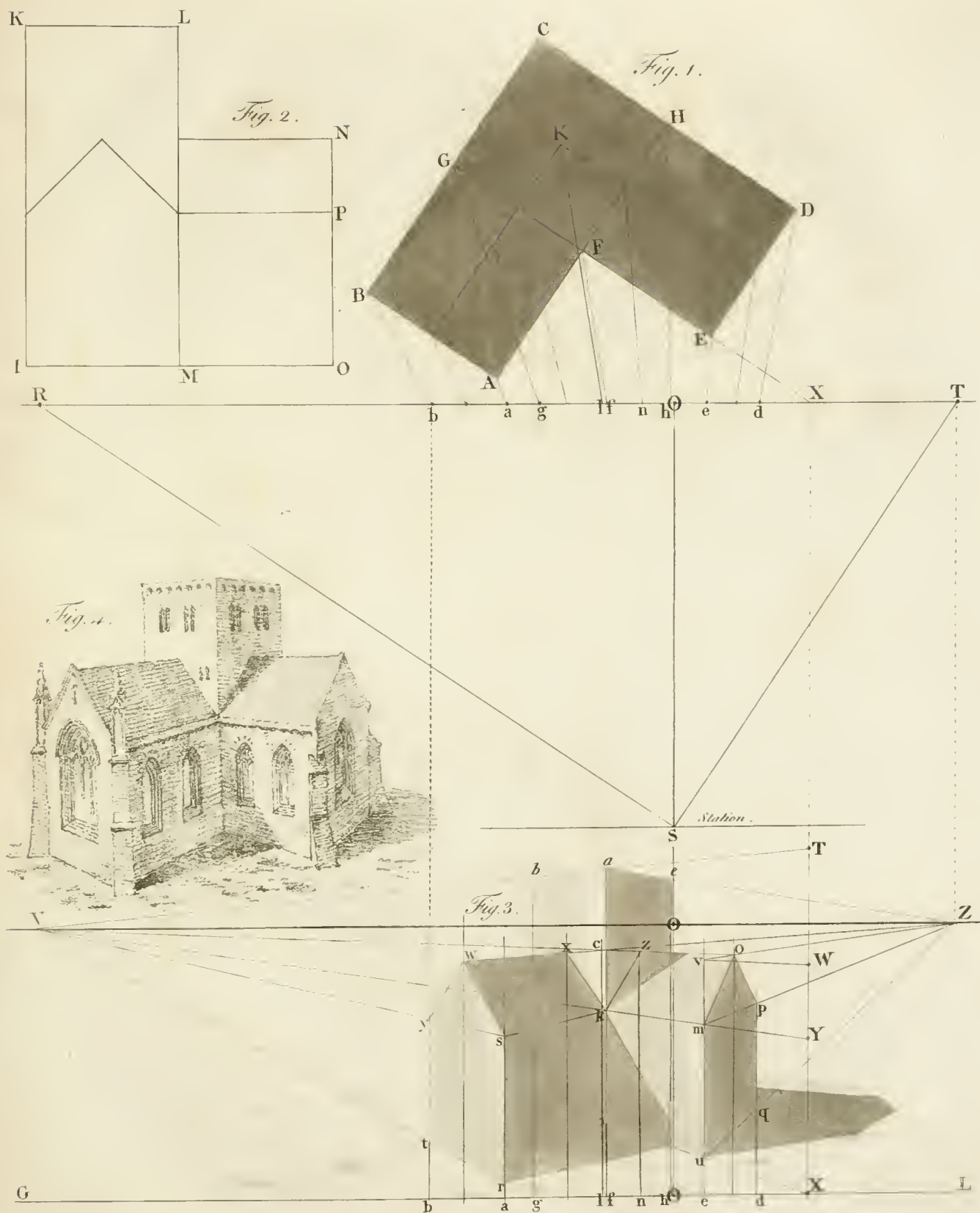
Let the form $ABCDEF$, Fig. 1, Plate 16, be the general plan of a building, of which, let the square $FGCH$ be the plan of a tower, and the other two parts $ABGF$ and $EFHD$ be subordinate parts, with gable-end roofs, and resting against the sides of the tower. Fig. 2, is a geometrical elevation of the building; $IKLM$ the height and breadth of the tower; ON the height of the roof of the lower building, and OP the height of the upright walls.

It is required to find the representation of the above building, as it stands posited to the plane of delineation at the line RT , from the station S .

Find the vanishing points R , and T , by lines from the station drawn parallel to the different faces of the building; also the centre of the picture \odot ; produce the line FE to X , for an intersection; and draw all the necessary visual rays. Prepare the picture, Fig. 3. Let VZ be the horizon; \odot the centre of the picture; V and Z the vanishing points of the horizontal lines; GL the ground line, and $\odot\odot$ the vertical line. Set off the distances of the points b , a , g , f , n , h , e , d , and X , Fig. 1, at b , a , g , f , n , h , e , d , and X , Fig. 3, and draw fine up-lines through them indefinitely; then proceed as follows:

On the intersecting line XT , Fig. 3, set up the height XY , equal the height of the walls of the building OP , Fig. 2. Also the height YW , equal the height of the roof PN , Fig. 2; and draw the lines Xi , Yk , and Wv , to the same vanishing point, V ; determining the plane of the building $uikm$, and the height of the roof on the angular line, at v . From the points v , m , and u , draw the lines vZ , mZ , and uZ , obtaining the height of the roof, at o , in its visual line; and by drawing the lines om and op , the whole gable-end $uompq$ is completed. Draw the ridge of the roof oz , cutting the end visual line n , in the point z , and draw the line zk ; then is the whole building over the plan $EFHD$, Fig. 1, completed; from which the other parts may readily be projected. Draw the lines ks , and ir , by direction to their vanishing point, Z ; also the lines sy , and rt , by tendency to their vanishing point, V . In the plan Fig. 1, produce the ridges of the two roofs till they meet, at the point K ; from which point draw the visual ray Kl , agreeable to which intersection, draw a visual line at l on the picture, Fig. 3; to which line produce the ridge of the roof oz , touching it at c ; from c draw the line cw , tending to the vanishing point Z , cutting the visual lines of the ridge of that building in the points w and x ; wx





is the ridge of the roof. Draw the lines $w y$, $w s$, and $x k$, completing the other building, over the plan $A B G F$, Fig. 1. The delineation of the tower is soon accomplished: on the intersecting line $X T$, make the height $X T$, equal the height of the tower $M L$, Fig. 2, and draw the line $T V$, cutting the visual lines of that face of the tower, in the points a and b ; from the angular point a , draw $a Z$, cutting the other visual line of the tower in the point e , which will complete the whole of the required representation. [Plate 16.]

Fig. 4 is introduced to show to what a complicated object, such a figure, as is just now obtained, may apply. I will give one more example on the true delineation of roofs, and then proceed to other objects.

EXAMPLE XI.

[Plate 17.]

Let the figure $F A B C D$ (Fig. 1, Pl. 17) be the plan of a building, the ridge of whose roof let be the line $H I K$; forming a gable-end at the face $A B$, and a hip at the end $E D$. Let Fig. 2 be the geometrical elevation of the said building, expressing the several heights; and let $P O$ be the height of the horizon.

It is required to find the figure such building would present, standing in the position and place it does, to the plane of delineation over the line $V Z$, from the station S ; the point of sight being equal the height from P to O , Fig. 2.

Obtain the centre of the picture \odot , as also the vanishing points of the different directions of horizontal lines in the building V , and Z ; draw all the visual rays from the visible angles of the building, cutting the ground line in the points $b, h, a, g, i, k, e, t, d$; and produce the face $G E$ to R , for an intersection.

Prepare the picture, by drawing the horizontal and ground lines $X Y$ and $G L$, parallel to each other and distant equal the height $P O$ (Fig. 2); fix the distances of the vanishing points, and place the centre of the picture, on the horizontal line Fig. 3 at X, Y , and \odot ; also set off the distances of the visual intersections at Fig. 1, at the corresponding distances, Fig. 3, and draw the visual lines perpendicularly through them.

On the intersecting line, $R D$, set up the several heights of the building $R A$, $R B$, $R C$, and $R D$, equal the geometrical heights $L m$, $r n$, $L W$, and $L M$, of the elevation, Fig. 2, and proceed with the delineation, as follows. The height $R C$, on the intersecting line, Fig. 3, is the height of the upright walls; describe it around the building, by means of the vanishing points, to the several visual lines, in the points r, x, w, v , and s ; and describe the bottom line of the building, to the same visual lines by means of the point R . The height of the roof, from the point D , may also readily be transferred to its proper place, as follows; First, to the extreme visual line in that direction of the wall of the

[Plate 17.] building, in the point *c*; whence convey it to the angular visual line through the point *a*, at *f*, by means of the vanishing point *Y*; and thence to its proper visual line through the point *h*, at *m*, determining the point of the gable-end, which the lines *m v*, and *m w*, complete. From the point of the gable, *m*, draw the ridge, *m n*, to its vanishing point *Y*; and the return of the ridge, *n o*, to its vanishing point, *X*: draw the hip lines *o r*, and *o s*; and the line *n x*, and the whole roof will be completed.

The shed, or lean-to, is obtained from its heights *A* and *B*; as may clearly and satisfactorily be seen, from examination of the figure.

The truth of delineation, that is, drawing agreeably to the strictest perspective, is unquestionably as requisite to be attended to in describing old and decayed objects, as in tracing the most perfect. Without due attention to truth in the delineation of the former, they may be most preposterously represented. It is not because being inclined, being really out of perpendicular, that they may be made to incline any how; they must be made so with judgment.

It is an advisable method to delineate a rude object, of any importance, truly, as if quite perfect, and then destroy it at pleasure, tempering the stroke of ruin with the hand of judgment. For instance, in the subject but just truly delineated (Fig. 3), and shown in a picturesque manner (Fig. 5); let it first be delineated strictly correct, in pencil, with every angle and boundary made perfectly sharp and regular, as is expressed by the sharp lines, Fig. 4; then, with the destroying hand of time, trace the rougher figure there drawn around it. The rude figure is not less under the governance of perspective than the perfect one, but only less indicative of absolute departure from truth. A tree is delineated perspective when delineated properly. "Delineate a tree agreeably to rule," I was told by a gentleman* to whom I made the observation, and who well understood perspective, and much admired it. "I will, my Lord," I replied, "if you will draw its geometrical plan and elevations."

It is a very pleasurable process, the breaking-down a regularly drawn subject into ruin; and it is done with the more satisfaction when it is performed with confidence, sensible at the same time it is not random work, but that it is true delineation governed by rule and judgment.

Thus far advanced, having gained considerable information on right-angled, or square objects, it is now expedient to turn attention to round ones, and from them make reference to many-angled ones, as hexagons and octagons.

* The late Lord Mountjoy, so lamentably killed, during the Rebellion in Ireland in 1798, at the battle of Ross.

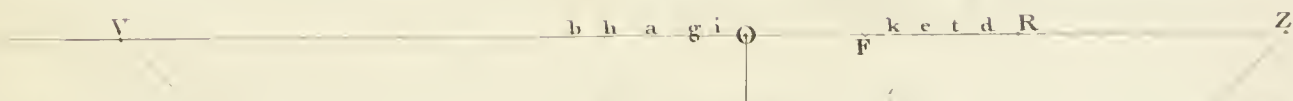
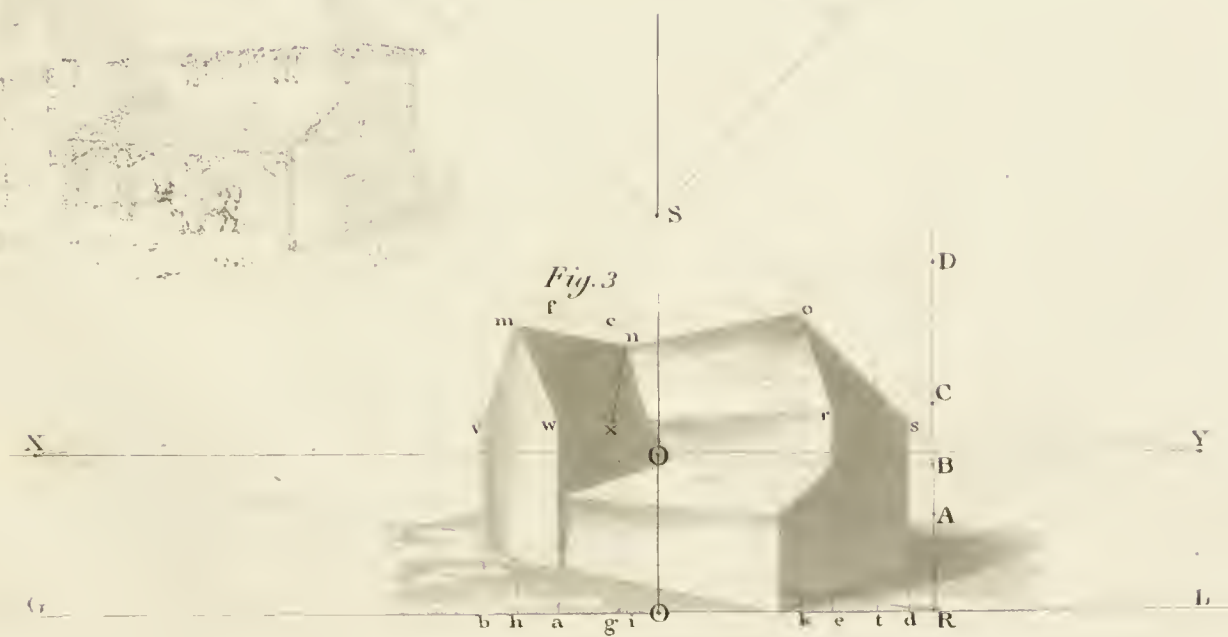


Fig. 4

Fig. 5



I know not for what reason writers on perspective commonly divide the subject of linear delineation into two parts, which they term rectilinear and curvilinear; there seems to be an evident impropriety in this division of the subject, since the same process, simply, is followed in both cases in determining of known forms, whether bounded by right lines or curves. It is generally observed on entering on the investigation of curvilinear delineation, that the perspective representation of a circle is a section of the cone of rays, which, proceeding from the eye to all parts of the circumference of the circle, is made by a plane cutting them in any direction: that when the section of rays is taken parallel to the base of the cone, the figure of the section made is similar to the base whence the rays proceed, that is, a circle. When the section is taken inclined to the base of rays, that then the figure made will be an oval*. And so they proceed till they have enumerated every different way a cone may be cut, and particularized the forms that would thence be assumed, making reference to the science of conic sections, as if convinced their readers were well versed in that ingenious and elaborate inquiry.

With equal propriety it might be said of any rectilinear figure, whether right-angled or polygonal, that a section of the pyramid of rays, formed by the eye viewing it, taken parallel to the base, will be a similar figure to the original, and that, taken in any other direction, would determine a figure considerably different and dissimilar. All this, though very true, forwards the subject nothing; and the student, unless acquainted with these truths, must rely solely on the assertion of his informer that it is so. The fact is, the operative part of all perspective delineation is by the intersection of right lines; that when right lines are to be obtained, by finding the extremes of them, the whole line is determined, and the representation of a solid bounded by planes is, on that account, very soon accomplished: but this is not the consequence with respect to the obtaining the representations of curves; a straight ruler will in no way coincide with a curved line between its two extreme points. There is no mode of procedure for determining the apparent forms of curved lines, but by finding points in the curvature, and by obtaining such sufficient number of them, that the hand may be enabled to trace the curve through them with adequate correctness.

* Except in one position, and that is, when the cone of rays is cut by the plane of delineation sub-contra-wise, as it is termed; that is, when the portion cut off is similar to the whole cone, then, of course, the bases of both, being similar, must be circular. But this takes place only in inclined cones.

[Plate 18.] When the curve is irregular, as the curve $A B C D E F G$ (Fig. 1, Plate 18), a point must be assumed at every considerable variation in the curve, as at B, C, D, E, F, G , and ordinates be dropped from them to the base or chord of the curve $A H$, as $B b, C c, D d$, &c. the various heights of which ordinates being found, the curve may be traced through their top extreme points with very sufficient correctness. Nor can any other mode be followed, let the curve be ever so regular; as a circle or an ellipsis. The only difference is, that the curve being regular, the points may be regularly assumed, and thereby be more easily found; but *however* regular the curve, it can be obtained only by finding points in its curvature. By circumscribing and inscribing a circle with a square (as Fig. 2), eight points in its circumference may readily be obtained by simply finding the representation of those squares; and this, whether placed horizontally (as Fig. 3), or vertically (as Fig. 4), or inclined (as Fig. 5), and, with care, the curve may be traced through them. Eight points I consider sufficient for tracing the curvature of an oval, even of considerable magnitude; but if not thought so by others, more may easily be acquired. Points in the curvature of the representation of an ellipsis, or oval, may also be obtained by circumscribing and inscribing it with rectangles, and finding those rectangles, as Fig. 6: so of a hexagon or of an octagon, by circumscribing them rectangulary, and drawing the regular parallel lines from one corresponding point to another, and delineating them merely, the required figure is likewise ascertained by only drawing the boundary lines from the points so obtained (see Figs. 7 and 8). By finding the rectangular circumscribing figures, and the parallel lines $A B, C D$, and $E F$, of the one, and $C H, I K, L M$, and $N O$ of the other; the hexagon and octagon will be described by drawing their boundary lines from the intersecting points made by the lines of the right-angled figures before found, as $C A, A D, E B$, and $B F$, of the one, and the lines $I L, N K, H O$, and $G M$, of the other. Not but that such figures may be more scientifically delineated by the aid of vanishing points, as will be shown by and by, but such method as is now pointed out has considerable advantages.

EXAMPLE XII.

It is required to find the perspective representation of an irregular curved line, described on a plane standing inclined to the plane of delineation.

The curve $A B C D E F G H$ (Fig. 1, Plate 18) is the curved line; let it be inclined to the plane of delineation, $I K$, in the angle $H I K$; and let S be the station point. The curve is supposed to stand upright on its chord or base $A H$.

Assume the points B, C, D, E, F, G, at the different variations of the [Plate 18.] curve, and draw the several ordinates Bb, Cc, Dd, &c. perpendicular to the chord of the curve A H, and produce the chord line, or base of the curve, to I, for an interfection. Find the centre of the picture \odot , and the vanishing point of the line A H, by the line S K being drawn parallel to it.

Prepare the picture (Fig. 9). Let X V be the horizon, and I L the ground line; I is the intersecting point, \odot the centre of the picture, and V is the vanishing point. Let the visual lines through the points a, b, c, d, e, f, g, and h, corresponding with the visual interfections at Fig. 1, be drawn.

Set up the several heights of the ordinates, Fig. 1, on the intersecting line I D, Fig. 9, at G, B, E, F, C, and D, and draw pencil lines from them to the vanishing point V, which crossing the corresponding visual lines, determine the points B, C, D, E, F, and G, through which the curve required may be traced with sufficient accuracy.

EXAMPLE XIII.

It is required to find the representation of a circle lying in an horizontal plane, and touching the plane of delineation.

Let the line M N (Fig. 10) be the length of a side of a square circumscribing the required circle; let \odot P be the horizontal line, and \odot the centre of the picture. The centre of the picture will be the vanishing point of the lines of the square perpendicular to the picture, the other lines will be truly horizontal, therefore be drawn parallel to the horizon.

If the Student describe a circle of diameter equal the side of the square M N, and therein inscribe a square touching its circumference, he will find the length from a to c (on the line M N, Fig. 10) equal the length of the side of the inscribed square (as 86, Fig. 2), which length he will divide and set off equally on each side the middle point b; and which is in the figure set down for the completion of the example enjoined.

Make \odot P equal the distance of the picture, or plane of delineation, that is, equal the distance of the eye from the plane of delineation; P will then be the vanishing point of one of the diagonal lines of the square, and a point on the horizon, equally distant on the other side of the centre of the picture \odot , would be the vanishing point of the other diagonal line. To obtain eight points in the circumference of the required circle proceed as follows:

Draw the lines M \odot and N \odot ; then the diagonal line N P, cutting the line M \odot in the point R; draw the line R S parallel to the line M N, and the figure M R S N will be the representation of the circumscribing square of the required circle. Draw the second diagonal M S, intersecting the first in the

[Plate 18.] point g; through which point draw the lines b g d to \odot , and e g f, parallel to MN, which will obtain the four points wherein the inscribed circle will touch the sides of the square, b, e, d, and f. Let the inscribed square be now described to obtain four other points in the curvature of the circle. Draw the lines a \odot and c \odot , cutting the diagonals in the points i, m, n, and o, which will be the four angles of the inscribed square, and four points of the circumference of the sought circle; which may very correctly be drawn through the eight points b, i, e, m, d, n, f, and o, as is shown in the figure.

EXAMPLE XIV.

It is required to find the representation of a circle in a vertical plane, perpendicular to the picture, the circle touching the plane of delineation.

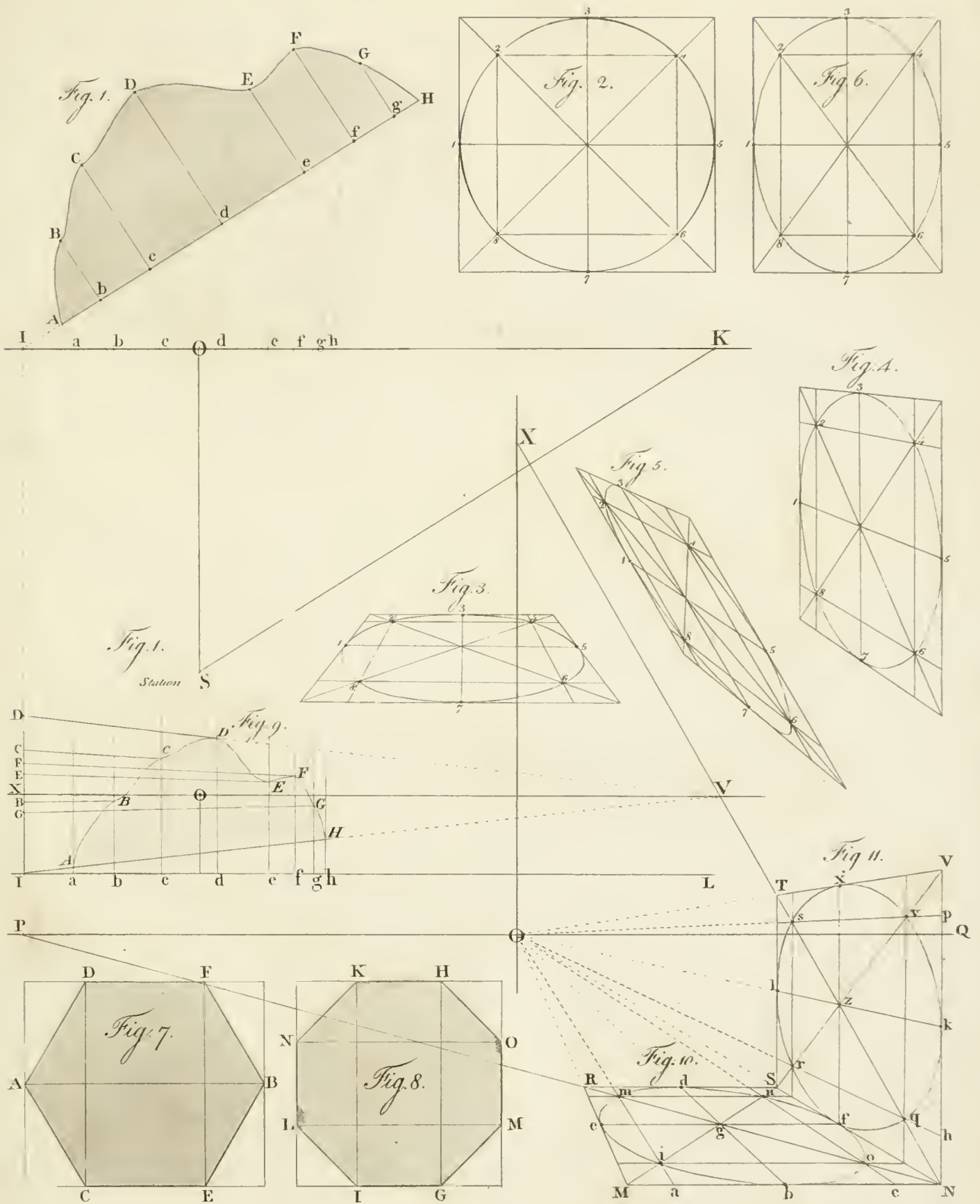
Let the line NV (Fig. 11) be the side of a square circumscribing the required circle; let P \odot Q be the horizontal line, and \odot the centre of the picture. The centre of the picture being the vanishing point of all lines perpendicular to the picture, will be the vanishing point of the top and bottom lines of the circumscribing and inscribed squares.

As was desired in the last Example, if the Student describe a square within a circle of the required dimensions, he will find it equal the length h p, set off equally on each side the middle point k.

Proceed as follows. Draw the vertical line \odot X, which line will be the vanishing line of the plane of the required circle (Def. 15). Make \odot X equal the distance of the picture (Def. 10), the point X will be the vanishing point of one of the diagonals of the square circumscribing the required circle.

Draw the lines V \odot and N \odot ; draw the diagonal NX, which, intersecting the line V \odot in the point T, determines VT for the side of the square; and drawing the line TS parallel to VN, completes the circumscribing square. Draw the diagonal VS, intersecting the other in the point z, the centre of the required circle; through which point draw the lines lz k, and xzf, determining the four points in which the circle comes in contact with the external square, the points f, x, l, and k. To obtain the internal square draw the lines p \odot and h \odot , which intersecting the diagonals of the circumscribing square, determine the four angles of the internal one, which are also four points in the circumference of the required circle; the points q, r, s, v. Eight points in the circumference are now obtained, viz. the points k, q, f, r, l, s, x, and v; through which the curve may be traced with very sufficient accuracy.

The two last Examples considered unitedly, will serve to exemplify the doctrine of vanishing lines; and the truth and infallibility of the rules of perspective delineation.



When arches are in a vertical plane, and the plane of delineation placed parallel to the plane they are in, they must then be truly geometrically drawn on the picture, their decreased dimensions, agreeably to their distance from the picture, must be obtained, which bisected, the arch must be struck on that centre. But when they are drawn as situated in planes inclined to the plane of delineation, that is, when they are the representations of original arches standing inclined to the plane of delineation, then will they vary each from the other, agreeably to their place and distance, and in just relation thereto.

When arches are of equal magnitude, on the same level, and in the same plane, as are the arches of a long arcade, the trouble of finding their apparent curvature, when inclined to the picture, is but little, as the same heights of the ordinates that serve for the finding of one serve for all, were they ever so many.

EXAMPLE XV.

[Plate 19.]

Let the three equal arches, No. 1, No. 2, and No. 3 (Fig. 1, Plate 19), standing in a plane inclined to the plane of delineation, IK, in the angle RIK, be required to be delineated; and let S be the station of the observer.

When arches are not drawn to a large scale, three points found in their curvature between their extremes, or springings, will be sufficient to trace their curves through. In the arches here required to be drawn, let the points c, d, e, No. 1; h, i, k, No. 2; and n, o, p, No. 3; be the points of the ordinates, taken all equally distant from their centres. The visual lines drawn from each of the ordinates, also from the extremes of the span of each arch, to the station S, will cut the plane of delineation in the points a, b, c, d, &c. Produce the plane of the arches to the plane of delineation for an intersection at I.

Let the three arches be supposed to be seen below the horizon, which let be equal the height IX, Fig. 2. The line XV will be the horizon, and IG will be the ground line. Set off the distances of the intersections of the visual rays a, b, c, d, &c. Fig. 1, from the intersecting point I, on the ground line IG, Fig. 2, a, b, c, d, &c. and draw the visual lines perpendicularly through them, and also a vertical line through the intersecting point I.

On the intersecting line IX, Fig. 2, set up the heights of the ordinates taken, of the required arches, that is, make It, and Iv, equal the ordinates ct, and dv, Fig. 1, and draw the lines IV, tV, and vV, Fig. 2, cutting the visual lines of the ordinates, in the points 1, 2, 3, No. 1; 4, 5, 6, No. 2; 7, 8, 9, No. 3; through which points the curves may be drawn from the springing of the arches with a steady hand with sufficient accuracy.

[Plate 19.]

EXAMPLE XVI.

Suppose the arches of the last example were required to be drawn above the horizon, at any height at pleasure, suppose at the height IN, Fig. 3; the horizon and station remaining as before.

The station and position of the arches being as before, the same visual lines with the last, both in plan and elevation, will serve; it will only be necessary to heighten the visual lines, Fig. 2, to Fig. 3.

Make Nx and Nz, Fig. 3, equal the heights of the ordinates ct, and dv, of the plan Fig. 1, and draw the lines NV, zV, and xV, cutting the visual lines of the ordinates and springings in the points o, o, o, o, o, &c. through which the curves may with care be traced.

Fig. 4, shows an arcade, standing on piers, agreeably to the dimensions and height of the arches of the last example.

Should the arches be unequal, as the arches of a bridge generally are, still the same mode of drawing ordinates, and finding their heights according to their distance, must be pursued. The arches differing in dimensions or in figure, that is, being either semicircular, segments of circles, or semi-ellipses, will cause only a little more trouble in the operation of finding them.

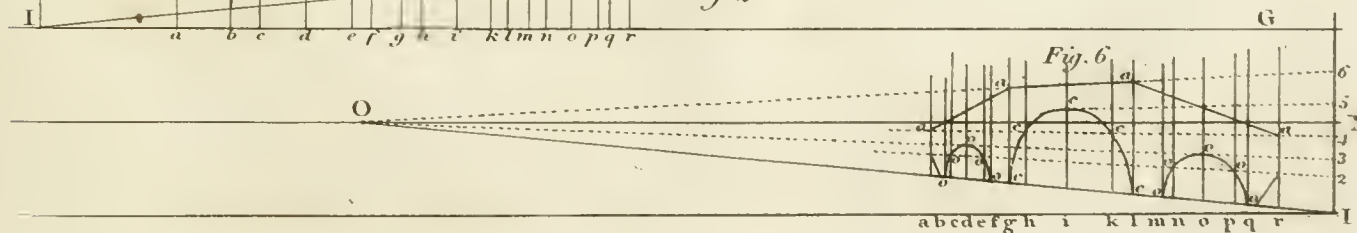
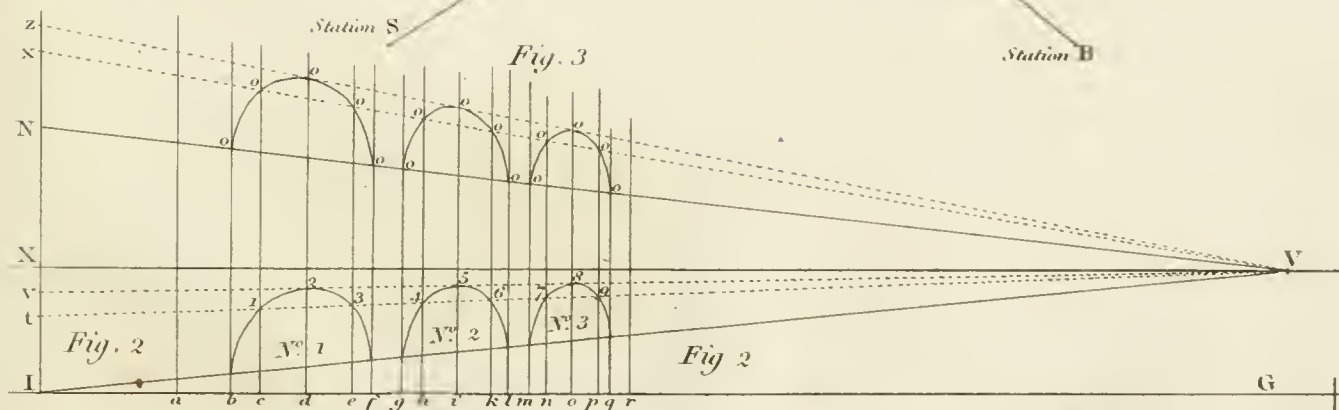
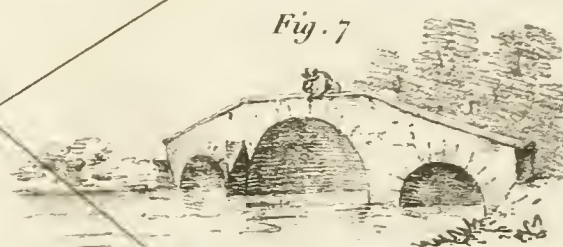
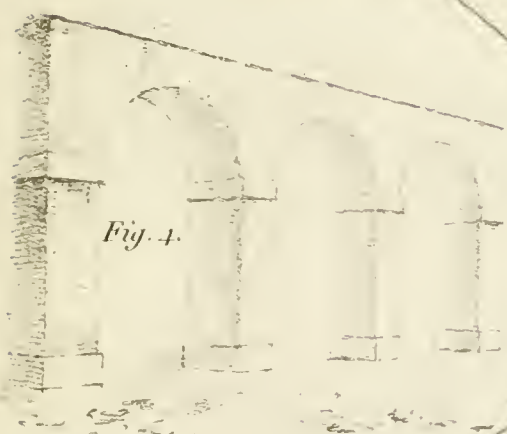
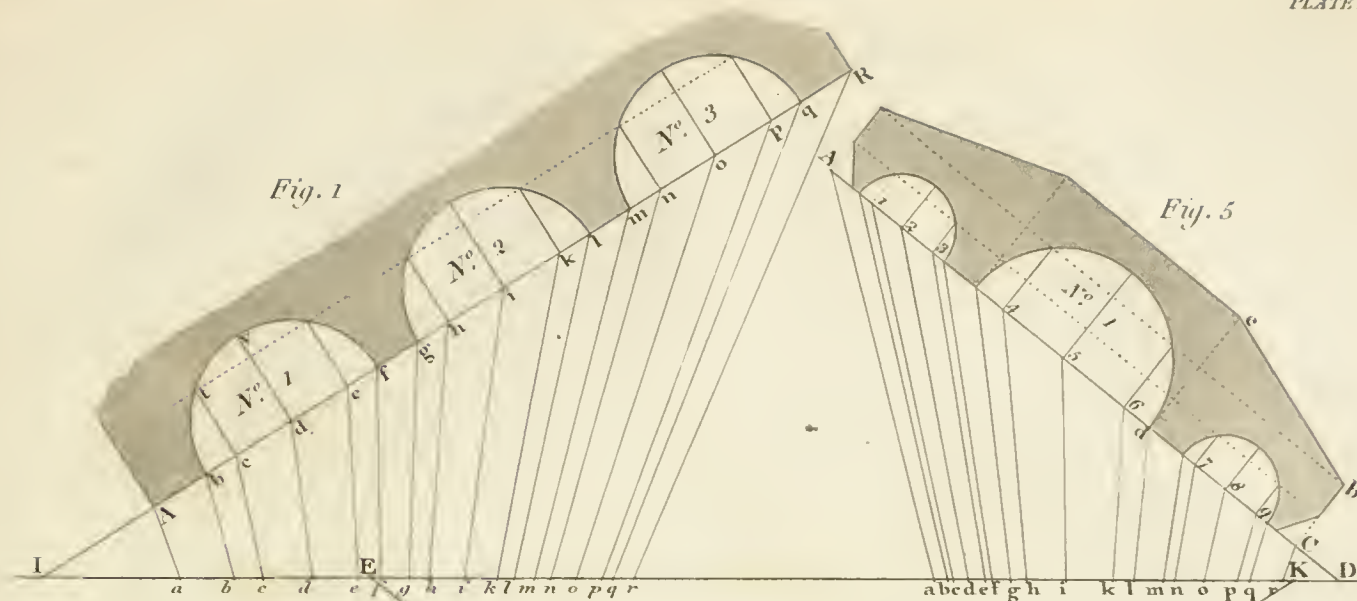
EXAMPLE XVII.

Let Fig. 5, be the geometrical elevation of a bridge. Let it be supposed to stand perpendicularly on the line AC; and let B be the station whence it is viewed. Let IK be the ground line of the plane of delineation.

It is required to find the perspective representation of the above bridge, under the stated premises, supposing the horizon equal the height IN, Fig. 6.

Let the ordinates of the different arches be regularly assumed; and from their points of intersection, 1, 2, 3; 4, 5, 6; 7, 8, 9, on the chord line AC, let visual rays be drawn to the station B, as also from the piers or springing of the arches, cutting the plane of delineation in the points a, b, c, d, e, &c.; and let the chord line AC be produced to D for an intersection. Draw the line BE, from the station B, parallel to the chord of the arches, AC, for the vanishing point of horizontal lines in that direction.

Draw the horizontal line ON, Fig. 6, and parallel to it the ground line through the point I. Make NO equal the distance DE, Fig. 5, and set off the distances of all the visual rays, Da, Db, Dc, &c. Fig. 5; at Ia, Ib, Ic, &c. Fig. 6, and draw the visual lines through them.



First, to obtain the points in the curvature of the two small arches, which [Plate 19.] being of a size, and their ordinates of equal height, the operation of finding the heights of the perspective ordinates will serve for both, as was shown in the last example. Make the heights I 2, I 3, on the intersecting line I N, Fig. 6, equal the heights of the ordinates of the small arches, Fig. 5, and draw the lines 3 O, 2 O, and I O, cutting the visual lines of the arches in the points o, o, o, o, o, and o, o, o, o, o; through which points the curve may be traced, as is there done^a. On the intersection, Fig. 6, make I 4, and I 5, equal the heights of the ordinates of the centre arch No. 1, Fig. 5; and draw the lines 5 O and 4 O, cutting the visual lines of the centre arch in the points c, c, c, c, c; through which the curve may readily be drawn. I 4 and I 6 are equal the heights of the coping of the bridge C b and d e, Fig. 5; from which points, if lines be drawn to their vanishing point O, the proper visual lines will be intersected, as in the figure, in the points a, a, a, a; joining which points, by right lines, completes the entire of the bridge, and, cleared of its operative lines, and shaded, would be as Fig. 7.

Thus, by finding of points in the curvature of regular or irregular lines, are their apparent forms obtainable, nor can there be any other method devised, by which that end can be effected.

EXAMPLE XVIII.

[Plate 20.]

Let it be required to find the apparent form of a circular structure, part cylindrical, part conical, in the shape of a potter's kiln. Fig. 1, Plate 20, is the geometrical elevation of the given structure; its base, A B C D, cylindrical; its superstructure, B E F C, conical. The circle a a a a, &c. Fig. 3, is the plan of the base, and the small concentric circle 4 4 4 4, &c. the dimensions of the circle of the top of the conical part, at E F, Fig. 1.

It is required to find the apparent form of such a figure, from the station S, the plane of delineation being at V Z, and the height of the horizon being equal the height A G, Fig. 1.

Circumscribe and inscribe the two circles of the plan Fig. 3, by squares, and draw visual rays from the angles of those squares to the plane of delineation. Produce the diagonal of the squares M K to I for an intersection, and draw a line from the station parallel to the diagonal, to obtain its vanishing point, which will be distant from the centre of the picture \odot , equal the distance S \odot .

^a The Student is advised to practise this Example to a much larger scale.

[Plate 20.] A line from the station S, drawn to the picture, parallel to the diagonal of the plan, would not come within the limits of the plate; half the distance is therefore taken, at s, and the line s Z drawn. $\odot Z$ will then be half the distance of the vanishing point, that is, $\odot Z$ will be equal $\odot s$, or half $\odot S$.

First, to the delineation of the cylindrical base. The two circles of the top and bottom being equal and parallel, 'tis only requisite to find them, and being joined together by the external vertical lines, tangents^a to them both, the whole figure is completed, as is shown, Fig. 5.

Prepare the picture, Fig. 4. The line KK is the horizon, and LM the ground line, distant from each other equal the height AG, Fig. 1. From the centre of the picture \odot , set off the distances of the several intersections of the visual lines from the plan Fig. 3, as also the intersecting point of the diagonal, I, at the corresponding letters b, c, e, and f, and L, Fig. 4. Draw the intersecting line LP, and the visual lines of the squares through the points b, c, e, and f, and make $\odot d$ on the horizon equal the distance of the vanishing point of the diagonal, that is equal twice $\odot Z$, Fig. 3.

On the intersecting line Fig. 4, set up LE, equal the height of the cylindrical base of the object AB, Fig. 1; and draw the lines Ed and Ld cutting the visual line of the exterior angle of the square in the points m and n, and draw the horizontal lines mo and np, to the visual line through the opposite angle of the square. Then draw the lines m \odot , n \odot , o \odot , and p \odot , and vw and rt, completing the circumscribing squares of the top and bottom circles. Draw the other diagonals, VO and rp, which, intersecting, determines the centres of each of the circles, through which centres, diameters being drawn to the middle of the sides of the squares, the four points are obtained wherein the inscribed circle touches the sides of the square.

The diagonal lines Ed and Ld also cut the visual line of the angle of the inscribed square in the point 2; and drawing the line 2 3, and the lines 2 4, and 3 5, to \odot , the internal square 2 4 5 3 is determined, and four other points in the curvature of the required circle are obtained; through which eight points the curve may very well be drawn. The same is to be done of the circle above the horizon, but it being so contracted in its appearance, from its nearness to the horizon, the process of obtaining it can better be traced from inspection of the figure, than by description. Draw the vertical lines ab and cd, tangents to the above curves, and the base of the figure will be completed; the extent of which will be found to be exactly the same with the square comprehended

^a A Tangent to a circle, or other curve, is a right line which just touches the curve, and of course in nowise coincides with it, but the curve quits it immediately on each side.

between the points of intersection x and z , Fig. 3, where visual rays from [Plate 20.] the station are tangents to the cylindrical base of the object.

To obtain the circle of the top of the object, draw the diagonal line Pd , first making the height LP , on the intersection, equal the height TR , Fig. 1.

The short lines e , f , g , and b , are the visual lines answering to the visual intersections o, o, o, o , (Fig. 3,) of the two squares circumscribing and inscribing the circle of the top, which intersections are set off from the centre point B , the ray of the dotted visual line in the middle of the object Fig. 4. Where the line e intersects the diagonal line Pd , draw the horizontal line e, b , and the lines $e \odot$, and $b \odot$, to their vanishing point \odot . Where the line $b \odot$ intersects the diagonal line at i , draw the horizontal line $i k$, and the circumscribing square $e b i k$ will be completed. Draw the other diagonal line of the square, and through the centre of the square draw the lines $o o$, and $o o$, determining four points of the curve of the circle. The inner square is obtained in like manner with the foregoing, from the lines f , and g , by which four other points are had in the curvature, 3, 3, 3, 3; through which eight points the circle may easily be traced. The circle of the top, and the circle of the base, being joined by the tangent lines ob , and od , the whole required figure is completed.

EXAMPLE XIX.

Let it be required to find the representation of a circular object, of which let Fig. 2 be the geometrical elevation. The base $ABCD$ is the same as the base of the former object, but the superstructure is somewhat different, as well as more complicated; the conical part being the form $HIKL$. The circular plan, Fig. 3, is as well the plan of the present as of the former object, with the addition of two circles expressing the dimensions of the structure at HL and IK . The circle of the gallery is the same, in diameter, as that at HL , and the top the same with EF of the former object.

It is required to find the perspective of the above object, Fig. 3 being the plan and situation with the plane of delineation VZ , and S is the station.

Let each circle of the plan, Fig. 3, be inscribed and circumscribed by a square; and from the angles of those squares, let visual rays be drawn to the plane of delineation, and let the general diagonal, LN , be produced to P for an intersection with the picture.

Let LM , Fig. 6, be the ground line of the picture, and let KK be the horizon. \odot is the centre of the picture, and g , on the horizon, is the vanishing point of the diagonal line, $\odot g$ being equal the distance $\odot V$, Fig. 3.

[Plate 20.] The visual lines through the points b, c, e, and f, Fig. 6, are the visual lines from the near angles of the two squares of the great circle of the base of the object. The height MO, on the intersection, is the height of the base of the object, equal the height DC, Fig. 2. The base of the present example being exactly the same with that of the former, it is needless to go through the process of obtaining it; the practice of the preceding, and inspection alone of this, will be ample information as to its attainment. MP, on the intersection, is the height of the circle HL, Fig. 2. The line Pg being drawn, intersects the visual line of the angle of the square, determining the point l of one of the near angles of that circumscribing square; from which point the whole may be readily completed; but which process being the same with the finding the circle of the gallery above, we will proceed to the description of it, as, being more discernible, it will better answer the purposes of both.

Draw up the visual lines cc, and ee, the visual lines of the two near angles of the square circumscribing the required circle. Make MQ, on the intersection, equal the height of the gallery TR, Fig. 2, and draw the diagonal line Qg intersecting the visual line ee, in the point e, answering to the point l of the square below. Draw the horizontal line of the square ce, and from the points c and e draw lines to \odot , the vanishing point of lines perpendicular to the picture. The line from the point c intersects the diagonal in the point m, from which draw the line mn, parallel to ce, completing the square ecmn; in which, draw the other diagonal en determining the centre of the circle a. Through the centre, a, let two lines be drawn through the square, one parallel to ce, and the other in direction to the vanishing point \odot , which will obtain four points, 1, 2, 3, 4, in the circumference of the circle. The short lines r and t, answer to the visual lines of the near angles of the inscribed square, agreeable to the visual intersections r and t, Fig. 3. Those lines intersect the diagonals in the points 5 and 6, from which, lines being drawn in direction to \odot determine the two other angles of the square, and points in the circle, 7 and 8; through which eight points let the circle of the gallery be drawn. The square 5 6 7 8, is the exterior square of the circle of the body of the object at top, in which, four points are already determined, x, x, x, x; and the four other points, z, z, z, z, are readily obtained from the visual intersections oo of that square in the plan Fig. 3, and the circle drawn through them; draw the lines of the conical body of the object xk and xl. There only remains to find the top circle at MN, Fig. 2.

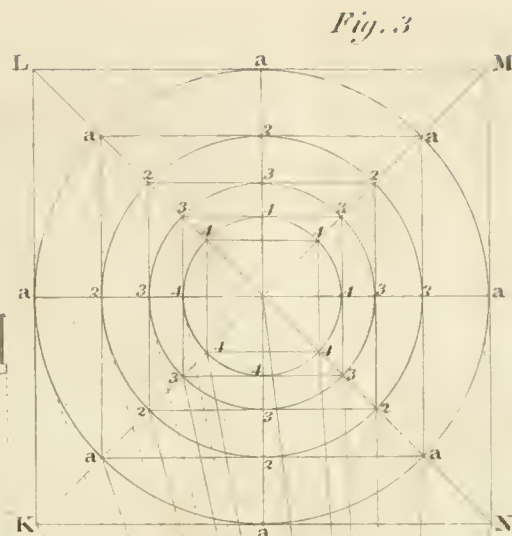
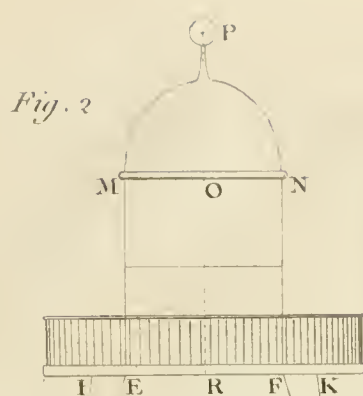


Fig. 1 & 2

Fig. 3

Fig. 1 & 2

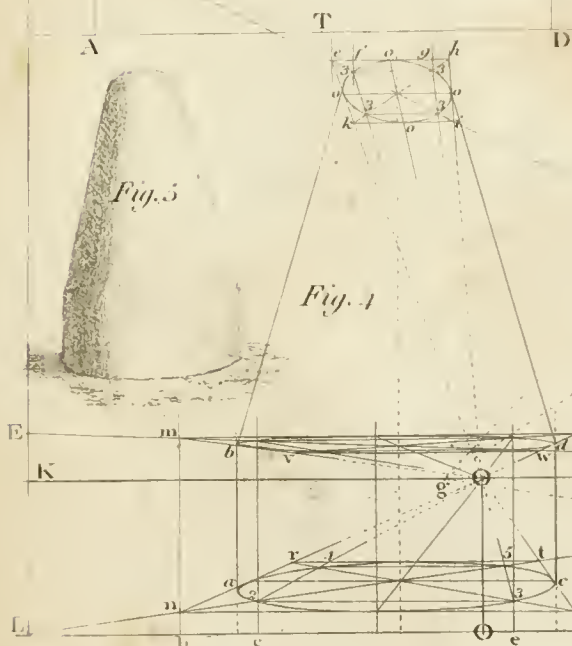
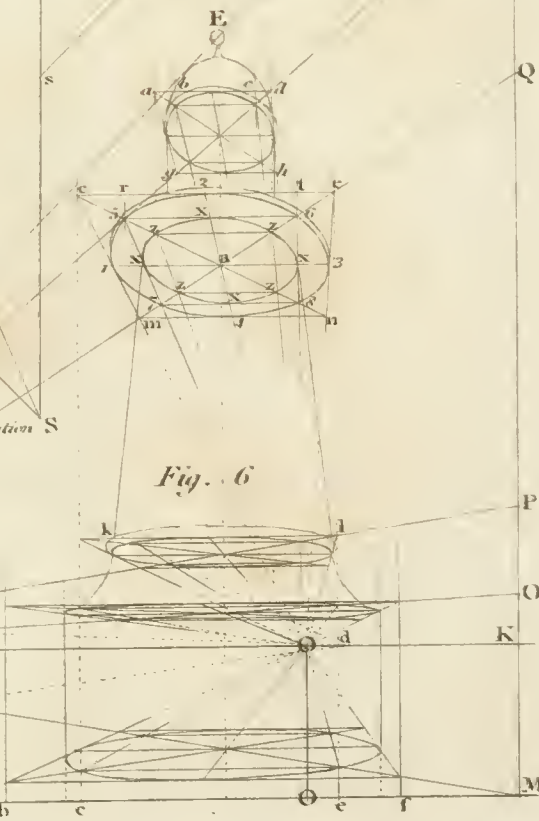


Fig. 5

Station S

Fig. 6



Make MR, on the intersection, equal the height TO, Fig. 2. and draw the [Plate 20.] diagonal line Rg, which cutting the contiguous visual line *d*, determines the point *d*, one of the angles of the outer square; from which point, the square *dagb* is obtained. The visual lines *a, b, c, d*, answer to the visual intersections o, o, o, o, from the angles of the corresponding square in the plan Fig. 3. The process of obtaining the inner circle being the same with either of the preceding cases, the mere inspection of the figure will suffice as to the process, and convey very ample information. The height MT, on the intersection, Fig. 6, is the height of the centre of the ball, equal the height TP, Fig. 2; and the line Tg being drawn, where it cuts the dotted line through the middle of the object, at E, is the place of the centre of the ball in the representation. Thus is the whole that is necessary to be obtained strictly by rule accomplished; the other lines and additions to the general figure are easily supplied by the hand and judgment. It would be perfectly irksome to obtain every minutia by rule; the leading figure and features being found, if the judgment cannot trace the rest, little will be done by such a hand.

The required lines being drawn in ink, and the operative lines rubbed out, the object will remain disencumbered, which shaded, may be, as Fig. 7, not unlike the light-house on the pier at Ramsgate, whence the idea was taken.

The mode that has been adopted to find the perspective of a circle, by obtaining eight points, regularly assumed, in its circumference, would as well have obtained the representation of an octagon, if, in place of tracing a curve through each two points so as it should fall in a flowing unbroken line through the succeeding, they had been joined together by right lines, chords to those same curves; as is shown geometrically Fig. 1, Plate 21, and perspectively in [Plate 21.] Fig. 2. But a still more simple method would be as before recommended and shown, Fig. 8, Plate 18, by drawing and finding the parallel lines from the extremes of the opposite sides; which we will now put in practice.

EXAMPLE XX.

Figure 3, Plate 21, is an octagon, around which, let a square IKLM be described; let the parallel lines CF, BG, and AD and HE, be drawn.

It is required to find the perspective appearance of the above octagon, by finding the circumscribing square, and the parallel lines within, from a given station and point of view.

Let the line VX be the place of the plane of delineation parallel to a side of the square. Let S be the station. The centre of the picture O will be the va-

[Plate 21.] nishing point of the lines perpendicular to the picture; and the distance of the picture $S \odot$, laid down on the horizon, on each side the centre \odot , will give the vanishing points of the diagonals of the square. Draw the visual rays in direction to the station cutting the plane of delineation in the points k, c, b, i, a, h, m , and produce the diagonal KM to N for an intersection.

Prepare the picture, Fig. 4, by drawing the ground line GL , and parallel to it, the horizon, YZ . \odot is the centre of the picture, and $\odot Y$ and $\odot Z$ are each equal the distance of the picture $S \odot$ in the plan, wherefore Y and Z are the vanishing points of the diagonals of the square, and of all lines parallel to them. The visual lines through the points k, c, b, i, a, h , and m , answer to the corresponding visual intersections in the plan. L , in the intersecting point, and LN , the intersecting line. We will first obtain the representation of the octagon as lying in the ground plane.

Draw the diagonal line LY , from the intersecting to the vanishing point. The point f , where it cuts the visual line through the point m , is the place of the near horizontal side of the square, fg . Draw the lines $g \odot$, $f \odot$, and $d l$, which will complete the square $fg d l$, of which, the line $d f$ is a diagonal. From the points e and e , where the visual lines through the points a and h touch the near side of the square, draw the lines $e \odot$, and $e \odot$, crossing the opposite side of the square in the points e and e ; and where they cross the diagonal $d f$ in the points v and x , let horizontal lines be drawn through those points to the opposite sides of the square, cutting them in the points e, e, e, e ; and drawing the corner lines $ee, ee, \&c.$ the octagon e, e, e, e, e, e, e, e , is completed.

Let it be required to find the appearance of the same octagon, as seen elevated above the horizon, directly over the one found on the ground plane; suppose equal the height LP on the intersection.

Draw the visual lines of the ground figure up to Fig. 5. Where the diagonal line PY crosses the near visual line in the point a is the place of the near side of the square around the octagon, and the horizontal line ab is that side. Draw the lines $b \odot$, $a \odot$, and cd , completing the square $abcd$. Where the visual lines, through the points a and h below, cross the side of the square ab , at o, o , let lines be drawn to the centre, \odot , crossing the opposite side of the square cd , in the points o, o ; and where they cross the diagonal line in the points m and n , let horizontal lines be drawn through those points to the other sides of the square, cutting them in the points o, o , and o, o ; the remaining sides of the octagon at the corners being joined together, the whole octagon o, o, o, o, o, o, o, o , is completed, as required.

Fig. 1.

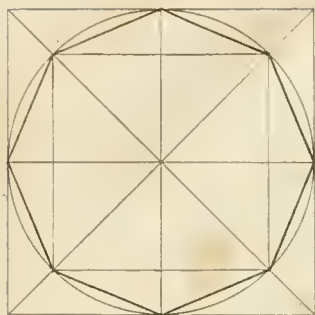


Fig. 2.

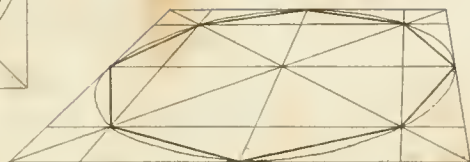


Fig. 3.

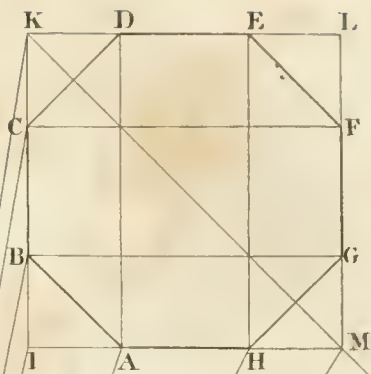


Fig. 8.

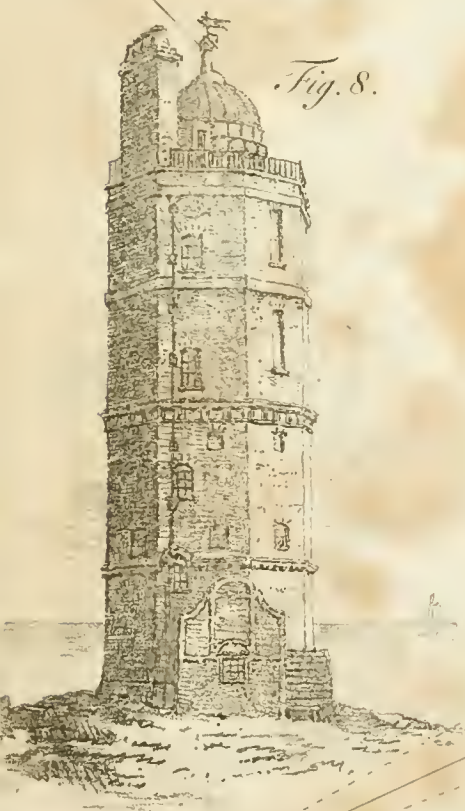


Fig. 7.



Station S

Fig. 5.

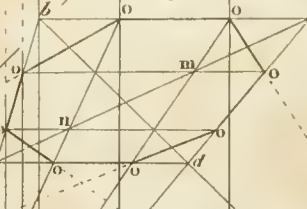


Fig. 6.

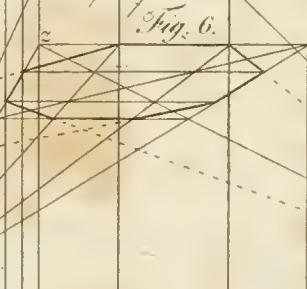
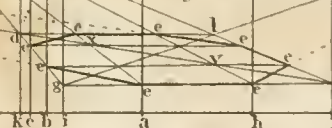


Fig. 4.





Thus, at whatever height required, the process of finding the figure is with [Plate 21.] facility performed: as suppose at the height LO, on the intersection; the diagonal line OY being drawn, cuts the near visual line, Fig. 6, in the point *e*, whence is drawn the side of the square *ez*; from which the whole may be completed by the same process as before shown in Figures 4 and 5.

The diagonal vanishing points Y and Z are as well the vanishing points of the corner sides of the octagon, as of the diagonals of the square; for those sides of the octagon are parallel to the diagonals (see the plan, Fig. 3); they will therefore have the same vanishing points. In the figures just obtained, if a ruler be applied to those lines, they will be found to tend correctly to their several vanishing points; to which they are continued, in the figures, by dotted lines agreeably to their direction. Thus will the use of those vanishing points contribute to the correctly delineating the figure, and at the same time illustrate the truth and beauty of the rules of perspective.

Joining the corresponding points of the octagons, above and below, by perpendicular lines, a solid figure will be formed, like to Fig. 7, or like to Fig. 8; where the rules, but just performed, are exemplified in an appropriate figure, and which is a view of the light-house on the North Foreland near Margate.

Thus by a very simple method may, apparently complicated figures be obtained, with the utmost correctness and facility. Thus may a hexagon be described (see Fig. 7, Plate 18), and so of any other regular polygon.

I will give one more example of general figures, more complicated than any that has hitherto been described; and after performing it, will proceed to give some general rules, governing the process of taking views, whether of single or many objects. This shall close the first division of my subject, which shall be resumed again with an inquiry into many interesting particulars and minutiae, whereby a more intimate knowledge cannot fail of being obtained.

EXAMPLE XXI.

[Plate 22.]

Let Figure 1, Plate 22, be the general plan of a church, which, like most country churches, let be composed of several parts. Let ABCD be its body; EFGH its tower; IKLM, and MLNO, be subordinate parts of the building; and let *a b c d* be the porch. Let Fig. 2, be its geometrical elevation; the ends and measurements *AB* and *BC*, answering to *IM* and *MO* in the plan Fig. 1; and the points of the roofs *D*, *E*, and *F*, Fig. 2, answering to the lines of the ridges *QR*, *TV*, and *PL*, Fig. 1.

[Plate 22.] *It is required to find the perspective representation of the above building, on the plane of delineation YZ, the station being at S.*

Find the vanishing points Y and Z, of the horizontal lines of the building by the lines SY and SZ being drawn from the station parallel to them. \odot is the centre of the picture. Draw the visual rays from the visible angles of the object, in direction to the station S, till they intersect the plane of delineation.

When a complicated object is to be drawn, that is, when it is composed of many parts, it necessarily gives rise to a number of visual rays for the precise determination of those parts, and the whole together will form an apparently confused number of lines. But the eye that views them properly sees no confusion in them; it views them as the eye of the astronomer views the starry hemisphere, placing each cluster, and arranging each straggling brilliant in its proper sign.

To avoid confusion of rays in a very complicated object, it is advisable to use different coloured inks in the classing of the rays, as also different degrees of strength of those colours to particularize different parts.

In the delineation of such an object as the present example, the first consideration is the choice of a proper intersection; for although any intersection will do, one should be chosen, which should unite most parts in its direction, with the greatest exactness and least trouble. In the present instance, none seems so eligible as the direction of the roof PLM, which let be produced to W.

In the picture, Fig. 3, GL is the ground line; let GV be the height of the horizon, the line VX will then be the horizontal line. \odot , in the horizon, is the centre of the picture, from which, place the distances of the horizontal vanishing points $\odot V$, and $\odot X$, equal the distances $\odot Y$ and $\odot Z$, Fig. 1. AB, Fig. 3, is the intersecting line, and all the visual lines on the plane of delineation are drawn agreeably to their intersections on the ground line in the plan.

On the intersecting line, the height AC is made equal the height AG of the elevation, Fig. 2; and the lines Cc and Aa being drawn in direction to the vanishing point V, determine the height ac, the height of that part of the building on the visual line answering to the ray from the point M in the plan Fig. 1. Through the points a and c draw the lines de and bf to their vanishing point X, determining the plane bdef, the representation of the plane AGHC, Fig. 2; the visual lines bd and fe answering to the rays from the points I and O, in the plan. Draw the lines dh and bg tending to their vanishing point V, to the ray from K in the plan, completing the plane bghd. On the intersection, make the height AD, equal the height of the roof NE of the elevation Fig. 2, and draw Di in direction to V; through i draw the line kl, to the vanishing point X, touching the visual lines of the roofs in the

points *k* and *l*; draw the lines *km*, *mh*, *kd*, *kc*, *lc*, and *le*, which will [Plate 22.] complete the whole of the structure over the plan *IKNO*, Fig. 1.

The height of the roofs of the low buildings is equal the height of the upright walls of the body of the structure, as is shown by the line *PR*, in the elevation Fig. 2; wherefore, the line *mo*, and the return line *on*, may be drawn to the visual lines corresponding with the interfections from the angles *A* and *B* of the plan. Also, from the angle *g*, the line *gs* may be drawn, which will determine the lines *sr*, *rt*, and *tp*, of the porch. Make *AE*, on the interfection, equal the height of the roof *BF* in the elevation, and draw the line *EV*, determining the ridge of the roof between the two visual lines from the points *P* and *L* of the plan. Draw the lines of the gable end *vo* and *vz*; the point *z* is obtained by the line *om* being drawn to its vanishing point *X*, cutting the visual line from the angle *D* of the plan, in the point *z*.

Make *AG* and *AF*, on the interfection, equal the heights of the tower, *BO*, and *BM*, of the elevation, and draw the lines *GV* and *FV*, cutting the visual line from *P* in the plan, in the points *a* and *b*; through which points draw the lines *ac* and *ef*, to their vanishing point *X*; and the lines *cd* and *eg*, to their vanishing point *V*; the points *g*, *e*, and *f*, being in the proper visual lines from the angles of the tower *F*, *E*, and *H*, in the plan. Complete the tower by drawing the lines *dg*, *de*, *ae*, and *af*.

The present example was contrived to elucidate the general practice of vanishing points, which are as well to be obtained of other positions of lines, as horizontal ones. It is not always that the vanishing points of inclined lines are required, but they are often useful, and sometimes absolutely necessary. In the geometrical elevation, Fig. 2, the lines *MO*, *PF*, *GD*, *IE*, are all parallel lines, as also are the lines *OV*, *FR*, *EH*, and *DI*; and though situated in different, yet they are in parallel planes, and will therefore have a common vanishing point. A line drawn perpendicularly to the horizon through the vanishing point *X* (Fig. 3), as *LQ*, will be the vanishing line of the plane of the end of the church over the line *IO* of the plan, also of the end of the body *AD*, likewise of the side of the tower *EH*. And a line drawn through the point *V* (Fig. 3), perpendicularly to the horizon, as *GM*, will be the vanishing line of the planes over the lines (Fig. 1), *IK*, *AB*, *ab* of the porch, and *FE* of the tower; and all lines in those planes, or the boundaries of those planes, will have their vanishing points somewhere in those vanishing lines^a.

To obtain the vanishing points of the inclined lines of the roofs and tower;

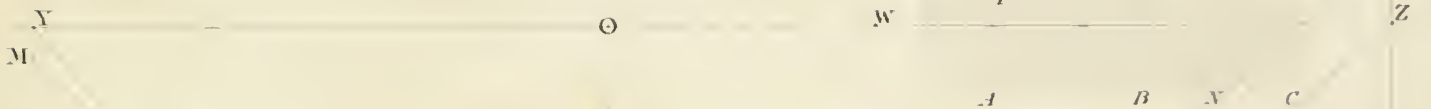
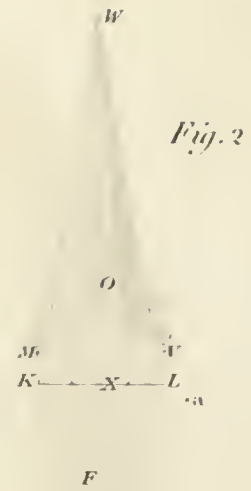
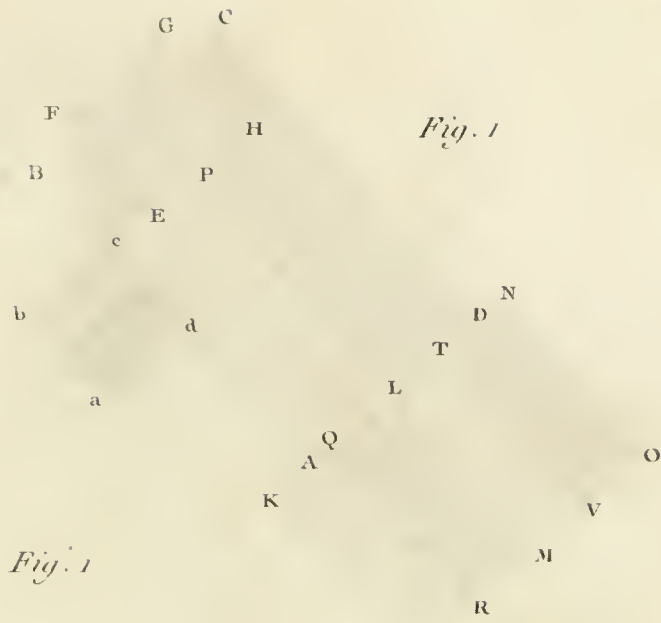
^a This circumstance of finding the vanishing points of inclined lines was before treated on in Example 8th, Fig. 5, Plate 15; but here it is more fully exemplified.

[Plate 22.] proceed as follows: take the distance of the vanishing point Z , from the station S , in the compasses; that is, take the length of the line SZ , and apply it on the horizon from X to H . At the point H make an angle with the horizontal line, equal the angle of the roofs aPc , Fig. 2; the curve KI , and the distance of it from the centre H , being equal to the curve ac , and distance of it from its centre P ; then is the angle KHI equal the angle of the roof aPc , Fig. 2. Produce the line HK to Q ; Q will be the vanishing point of the line ea of the tower, also of the parallel lines ov , dk , and cl ; which, though obtained by a different process, will all be found, by application of a ruler, to tend truly to that point, as is shown by the dotted lines in the example.

A like process being performed of the distance of the vanishing point Y , from the station S , will obtain the vanishing point of the same inclination of lines in the other planes of the object. Take the length SY in the compasses, and set it off on the horizon, from V to N . At the point N , make an angle INT , on the horizon, equal the angle KHI , that is, equal the angle of inclination of the roof, aPc , Fig. 2. The line NT produced to M in the vanishing line GM , will be the vanishing point of the line de of the top of the tower, also of the lines $w3$, and $y5$, of the porch (the inclination of the roof of the porch being the same as the other roofs of the body of the church), as is shown by the dotted lines in the example. The walls of the porch are obtained from the height AP , on the intersection, equal the height AT , Fig. 2. Pm being drawn to the vanishing point V , and mn to X gives the lines $n5$, 53 , and 32 .

It must be observed that the inclined lines af , le , kc , and vz , have a common vanishing point, obtainable if required; and which vanishing point will be in the same vanishing line with the point Q , and as much below the horizontal vanishing point X , as the point Q is above it; to which point, were it obtained, those lines, already drawn, will be found exactly to tend. It is seldom absolutely necessary to have both those points; in the present instance one of them only, the point Q , is obtained, which would answer every end required of both; for supposing it were left to that vanishing point for the finding the inclined lines, the visual lines being drawn, and the heights of the upright walls being found, the line dk drawn in direction to the vanishing point Q , determines one side of the gable-end at the visual line in the middle; the other is accomplished by joining the points k and c together. So of the other gable, cl being drawn, le is also had by joining the points l and c together.

To complete the whole, draw the line $x7$, on the tower, from the point x , to the angle of the tower, in direction to the vanishing point Q ; then

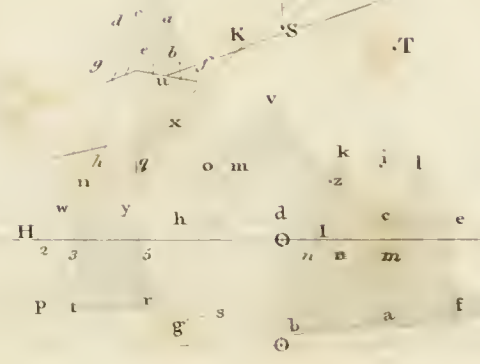


B

Fig. 3



Fig. 3



draw the lines qb , and nb , to their proper visual lines, and vanishing points [Plate 22.] V and Q . The putting on of the spire is a work of some consideration, and must be proceeded on with thought and care. The base of the spire is intended to be a regular octagon. If the two external lines in the geometrical of the spire, be continued till they touch the sides of the tower, as is done at K and L (Fig. 2), and an octagon be there constructed, extending the square of the tower, it will be the base of the spire. Set up the height of the spire BW , Fig. 2, on the intersection, Fig. 3, at B ; also the height of the base line KL , at R ; and draw the lines BV and RV ; the first, cutting the visual line through the centre of the tower in the point O , determines the height of the spire; the other, cutting the tower in the point u , determines its base. Through the point u draw a line around the tower, and find the points of the octagon in the middle of each face of the tower, to which let lines be drawn from the top O , and the spire and whole object will be completed, as is shown in the Example.

I have now gone through the process of finding the above complicated object. I had expectations of performing it with less confusion of lines than the result has made necessary; but one thing succeeding another, and each necessitated to remain, for the observance of the student, the whole together unavoidably becomes intricate. Nor is it now so entirely performed, but that something remains for the student to complete, but which would take more words to make clear, than the description of the whole has done. What I allude to is, the intersections that take place at the lodgment of the spire on the top of the tower, which, for clearer observance, is drawn to a larger scale at Fig. 4; the mere inspection of that figure will serve to convey a full, and I hope satisfactory, idea of what I allude to. The Student has also been left to complete the base of the octagon, which, no doubt, he is well enabled to do, or he has gone through the work to little purpose. As before observed, it is next to an impossibility to give such thorough explanation in intricate matters as to leave nothing for the Student to exercise his own judgment on; however copious his instructor may be, there will always sufficient remain undone to keep alive the active powers of his pupil, and give him opportunity of exerting his own ingenuity. That scholar must not sleep who would instruct himself in science from book alone.

Fig. 5 is a picturesque representation of the object just performed, which is the form of a church very commonly met with in the country.

Having, by the exercise of the foregoing examples, advanced the Student to some tolerable knowledge of the practice of perspective drawing, I will now

enter into an inquiry of a very important consideration. Methodically proceeding, it should have been antecedent to any practice ; it is, however, sometimes expedient to do that first, which in just progression should follow ; as it is not until some insight is had into a subject that the necessity of certain inquiries becomes evident.

It has been matter of much difference of opinion, the adjusting what may generally be considered the best angle of vision, within which objects should be regarded to obtain the most agreeable representation of them. For, accordingly as the angle of vision is enlarged or lessened, by viewing the objects near or remote, will their appearance vary, and their delineation in consequence be affected thereby.

[Plate 23.] By the angle of vision, or angle of view, is to be understood, the expansion of the lines, proceeding from the eye, by the two extreme visual rays embracing the whole extent of the view ; and this, whether it consist of one object or of many. This can clearly be explained only by reference to some figure. (Fig. 1, Plate 23.) Let A represent the plan of a mansion ; let B be the situation of an outhouse contiguous to the mansion ; and let the places of trees be intimated by the spots C, C, C, and D, D, D. Let S be the station or point of view whence the whole is regarded. Considering the mansion A, as a lone object, the extreme visual rays Sa, Sb, form at the eye, the angle aSb ; then is the angle aSb the angle of view under which that object is seen, Sa and Sb being the two extreme visual rays embracing the whole extent of the object. Again, if the outhouse B be considered as a lone object, then will the extreme visual rays, cS and dS, form, at the eye, the angle cSd, being the magnitude of the angle under which that object is seen. And so of any object, the visual rays that embrace its whole extent, form the angle of view under which it is said to be seen. It must be manifest then, that this angle of view will be large or small, as the eye is near to, or remote from the object.

Let it be intended to take both objects A, and B, into one view, with the addition of trees to the right, and to the left of them. Let visual rays be drawn from the extreme tree on either side, to the station S : the angle CSD is the angle of view under which the whole extent is seen ; and the rays CS and DS are denominated the extreme visual rays of the view.

Objects may be placed too near the eye for satisfactory observance of them ; they may be placed so near as to pain the eye. The eye can contemplate only a point at one time ; it is by its celerity and continual motion, that it becomes perfectly sensible of a whole, or many forms. But when an object, or many

objects, widely extended, are placed too near, the traverses of the eye in contemplation of the whole become painful. It is not necessary for me to account *why* it is so, but *that* it is so, every one must have experienced; and when that is the case, the cause, or the eye, is removed to a more agreeable distance, or the head, as well as the eye, is turned from one side to the other, the better to comprehend the extent of the object or objects in view. [Plate 23.]

The necessity of turning the head should be avoided in taking a view: a view should comprise no greater extent than the eye can agreeably contemplate at one *coup d'œil* (or glance of sight), or than can be viewed by a pleasing and satisfactory traverse of the eye alone; which necessarily confines the extent of matter, and of course the angle of vision, to some certain limits. The eye rests with composure on what it can contemplate with little trouble; not only too great an extent, but too many objects, however they may interest and delight at first, soon distract and tire the eye, a circumstance that may account why a picturesque bit gives more delight than an extensive scene comprising many parts.

Smallness of object has nothing to do with angle of view; a die, or the smallest miniature, by being placed too near the eye, may form a large angle of view, and cause the eye pain in observing it. A large extent of view, or a large picture, may be contemplated with as much ease as a small one; it is only placing the larger at a greater distance. If the place of the plane of delineation be at FG (Fig. 1), then will the angle FSG be the angle of view. If a section of the same visual rays be taken at HI, then will HI be the extent of the picture, and the angle HSI be the angle of view; but the angles FSG and HSI are one and the same, of consequence the eye can contemplate either picture with equal satisfaction^a; but then one must be placed at the distance SO, the other at the distance SP.

From whatever station an object be viewed, however distant, or however near, it never appears otherwise than on reflection we know or expect it should do. Far different is the case with respect to perspective delineation on planes, according to certain positions. To find the representation of a circle, viewed horizontally, assume the figure of an upright oval, as Fig. 2: or the representation of a square so posited, assume the form K M N L, Fig. 2; must certainly excite doubt in the mind of the *young* student, as to the truth of the

^a In this view of the subject of vision, what is termed near, or short sightedness, is not taken into consideration, that is looked upon as a defect in the organ itself.

[Plate 23.] rules by which such delineations, so repugnant to belief, are ascertained, and given as the representations of such well-known forms. Yet such may nevertheless be true and just representations, according to the point of view taken, and position chosen of the plane of delineation.

It is the shortness of the distance of the eye from the plane of delineation, that causes such unpleasant distortion. This may clearly be seen by inspection of Fig. 3, where, let the figure $ABCD$ represent a square lying on the ground plane; let the plane GHL be the plane of delineation, and let E be the point of view. It must be evident by the visual rays EA and EB , that the figure $DabC$, on the plane of delineation, is to the eye at E , the representation of the square $ABCD$, and that an oval described therein would, of course, be the representation of a circle, and would be as much distorted as the oval within the square $KMNL$, Fig. 2. But let the eye be removed to a greater distance from the plane of delineation, suppose to the point E , then will the representation of the square, and circle within, come within more admissible and pleasing forms; as may be gathered by the visual ray to the farther place of the eye E in the diagram, Fig. 3, determining the figure $DefC$ as the representation of the same square; and which seen directly before the eye, would be as the lower square $KOPL$, and circle within, Fig. 2.

To fix upon an angle that should extend to every case, as being the *best* angle of view, would be as vain, as it would be an absurd endeavour. Different subjects require different treatment; inside subjects different from external ones, and external ones from each other, as they happen to be situated.

The angle of view, as was before observed, is regulated by the distance of the eye from the plane of delineation. Thus, if GL , Fig. 4, be the extent of the picture, and A the distance of the point of view, the angle GAL will be the angle of view; and so on, every remove of distance varying the angle of view of the same extent looked at. Some authors on perspective have expressly advised, that the greatest distance of the eye from the picture should not exceed the width of the picture laterally, which makes the angle of view fifty-three degrees. Others would have the distance less, requiring the angle of view never to be smaller than an angle of sixty degrees; such is the angle GAL ; others are for having a still less distance to be the greatest used, and, of consequence, would have a larger angle of view than sixty degrees. My Father, who, I am persuaded, speaks from more practical experience than any of his predecessors, advises the extent of the picture, laterally, to be the least distance used, its angle of view fifty-three degrees, or at the very most, sixty

degrees, to the largest angle of view ; and recommends an angle of forty-five de- [Plate 23.] grees as the best angle of view, being, in his opinion, neither too large nor too small; such is the angle GBL. It is his advice to keep between the one and the other, that is, not to let the angle of view exceed sixty degrees, nor be less than forty-five ; too large an angle of view subjecting the objects to distortion, and too small a one rendering them too tame. His advice I know, from my own experience, to be strictly good ; I have, however, in some instances, in actual views, experienced the absolute necessity of using a larger angle of view than sixty degrees, but such do not often occur. After all that can be said, determination in this particular must ever be left to the discretion of the artist, and the absolute necessity his subject lays him under, as to the adoption of his angle of view.

The angle of view determined, as also the extent of matter to be included in the view settled, it will then remain to place the plane of delineation in the most judicious manner. In regarding a picture, the observer, in general, places himself in the middle of it, between its lateral extremes, with his eye perpendicularly opposite to where the horizon is concluded to be, as nearly as he can determine it. Such being the station whence a picture is usually regarded, from such point of view it should be that the artist should calculate his effects to be the most perfect, both as to linear and aerial perspective ; and which, as far as the influence of linear perspective extends, is very easily effected.

The angle of view being determined, how to place the plane of delineation in the most judicious manner, before the eye of the observer.

Bisect the angle of view, and place the plane of delineation at right angles with the line of bisection ; which also place nearer or farther from the point of view, as the picture is required to be small or large.

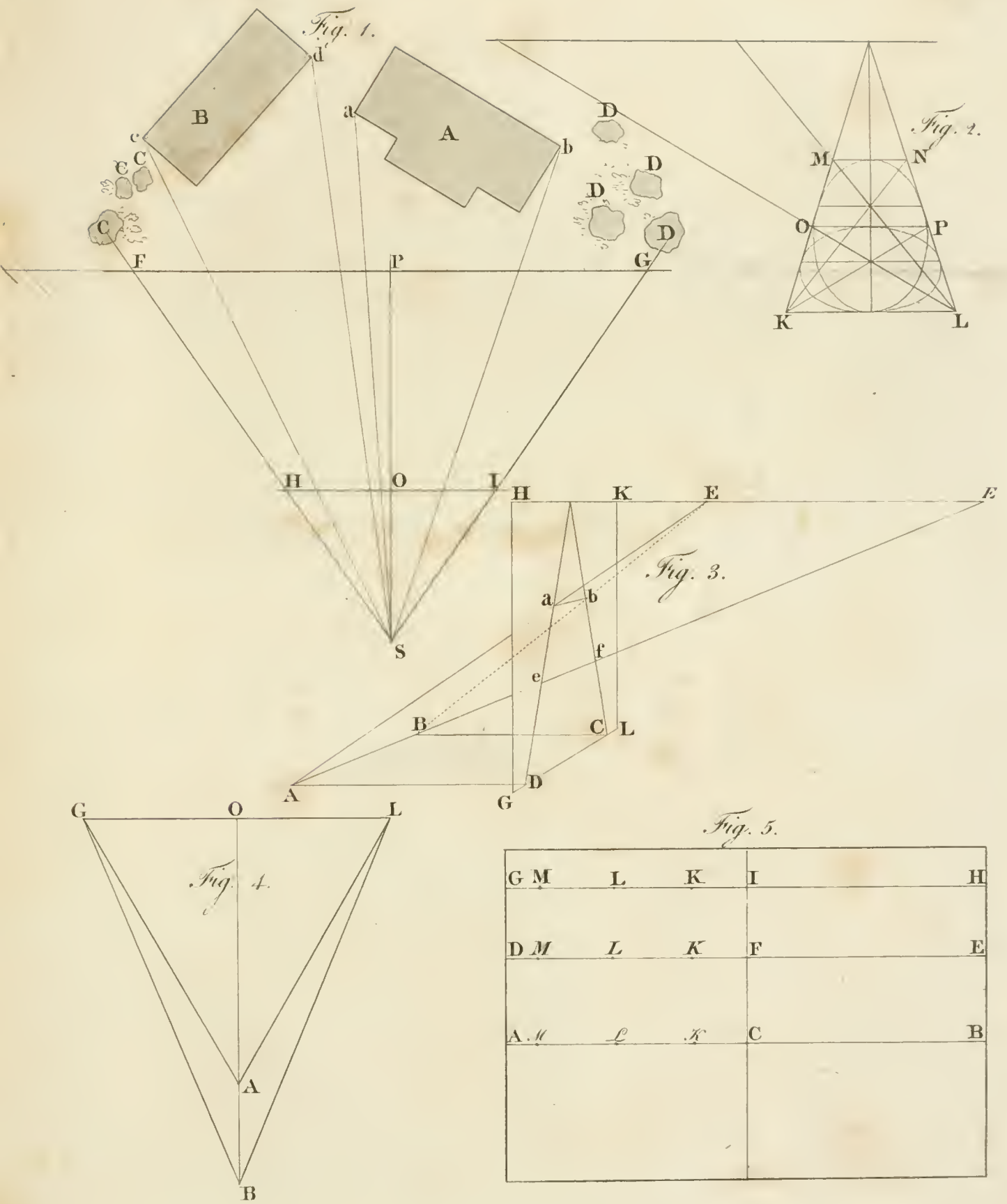
The angle of view, FSG, Fig. 1, Plate 23, is bisected by the line SP, and the pictures FG and HI are each placed at right angles, or perpendicular to the line of bisection, SP ; each of which pictures stands directly before the observer, as required : others might be thus placed, at pleasure, agreeably to the dimensions of the picture desired.

From such position of the plane of delineation, the eye of the observer, or, what is the same thing, the point of view, comes directly in the middle of the picture, laterally, with the eye level with the horizon ; and from the station generally chosen to regard a picture, a picture so proceeded on must make its most perfect appearance. In some cases, however, this absolute position may, and must be deviated from ; but it is necessary to know where perfection is, that departure from it may be known, in order that such departure may be the least possible, agreeably to the subject in hand.

[Plate 23.] Let the boundary line around Fig. 5, be the dimensions of a picture. Let the line *AB* be the horizon, parallel to the bottom edge, or ground line of the picture; then will the point *C*, in the middle, be the point that should be opposite the point of sight, or point of view; which point *C*, late writers on perspective have termed the centre of the picture, and which has been so defined in this work. If the horizon, which is quite arbitrary, be placed higher on the plane of the picture, as at the line *DE*, then would the point *F*, agreeably to the principle laid down, be the most eligible place for the centre of the picture. If the horizon were taken still higher, as in such representations as are termed bird's-eye views, at *GH* for instance, then would the point *I* be the best situation for the centre; always placing it in the middle between the two extreme ends; as then the spectator being directly before the picture to observe it, places himself nearest its true and just point of view, which would not be the case, had the effects of the linear representation been calculated from the point *K*, *K*, or *K*; less so if it had been calculated from the point *L*, *L*, or *L*; and still less so, if delineated agreeably to the point *M*, *M*, or *M*, as the centre; but which, from want of knowing better, are often as erroneously, though unwittingly, delineated.

From what has now been advanced in this work, if thoroughly understood, it is possible to perform any thing that linear perspective can effect; but it is apprehended, few will feel themselves competent to such a trial. There are persons of such profound thinking, so acutely penetrating, that from a closely compacted theory can extract a general practice. To such, BROOK TAYLOR's condensed Elements on this subject, would be ample insight. But works like his are not addressed to the many: one compacted general observation needs much elucidation to make it manifest to the multitude: wherefore the necessity of works of a more open inquiry, of more familiar and minute instruction, and according to the different powers and intention by which authors work, different roads are made to the same summit, and each who follows will prefer that path which, most agreeably to his humour, will conduct him to the object he wishes to attain.

The endeavour to avoid trouble is continually instanced in every occupation in life: Lazy persons give themselves most trouble, says the proverb. Complaint may be made of the extraordinary tediousness of true perspective delineation, and impatience may spurn at the apparent tediousness of the process. From my own experience I have ever found, when by laziness or impatience I have been induced to slight or reject the application of rule, that at last I have been forced to have recourse to it, even for the advantage of that dispatch



I was endeavouring otherwise in vain to obtain, and after considerable time had [Plate 23.] been lost, to waive the necessity of the appeal. Thus had the aid of method been first applied to, not only much time had been saved, but the delusive effect required been better accomplished. However strong the wish to shorten the road leading to a desired object, that way is not always found the readiest, that seemingly points the most directly to it. Sir Joshua Reynolds, in his *divine Discourses on Painting*, most aptly speaks my sentiments; and says, “The impetuosity of youth is disgusted at the slow approaches of a regular siege, and desires, from mere impatience of labour, to take the citadel by storm. They wish to find some shorter path to excellence, and hope to obtain the reward of eminence by other means than those which the indispensable rules of art have prescribed.—In this art, as in others, there are many teachers who profess to show the nearest way to excellence; and many expedients have been invented by which the toil of study might be saved. But let no man be seduced to idleness by specious promises. Excellence is never granted to man, but as the reward of labour.”

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